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THE BUREAU OF SUPPLIES

OF THE

DEPARTMENT OF WATER SUPPLY GAS AND ELECTRICITY

NEW YORK CITY

By **ELIHU CUNYNGHAM CHURCH**

**A Dissertation submitted in partial fulfilment
of the requirements for the Degree
of Doctor of Philosophy in the
Faculty of Pure Science,
Columbia University**

UNIVERSITY OF
CALIFORNIA

NOVEMBER, 1913

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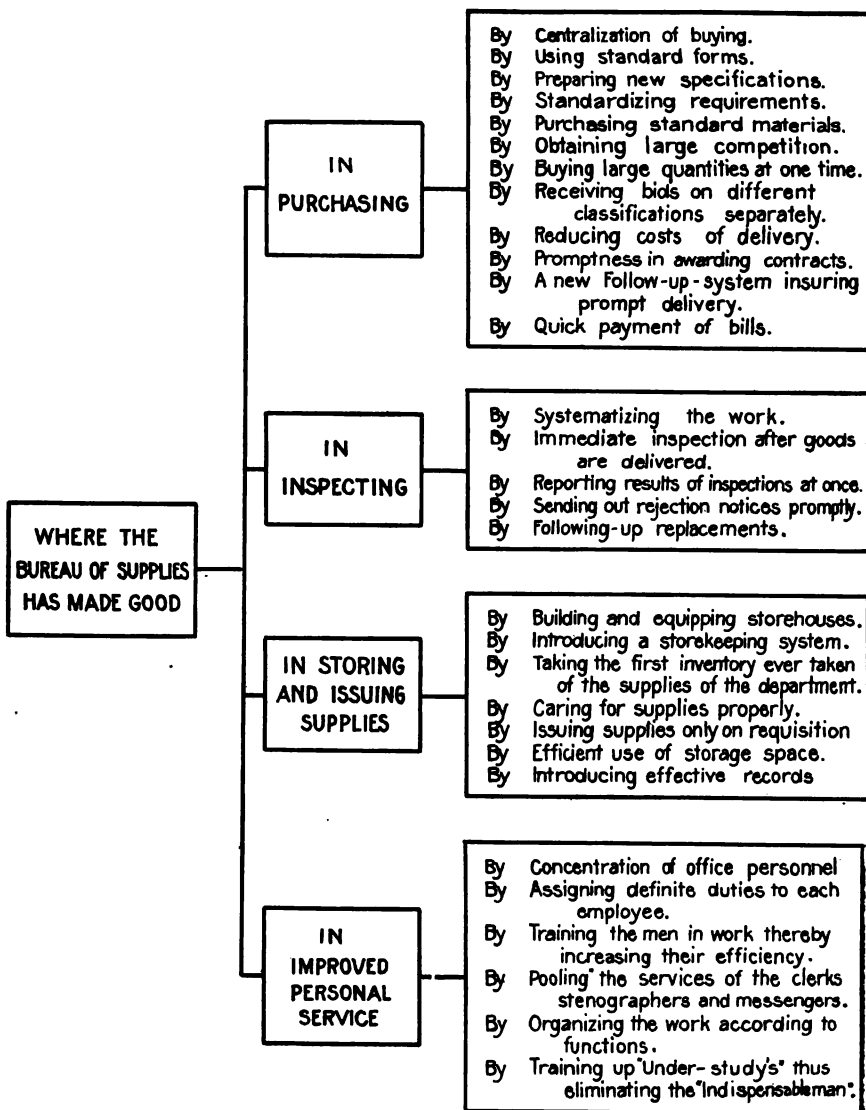


TO VINI
AMFORLLO

THE BUREAU OF SUPPLIES

TABLE OF CONTENTS

CHAPTER I.	
PLAN AND SCOPE.	
The work of the Bureau of Supplies and its relation to the rest of the organization	PAGE 7
CHAPTER II.	
ORGANIZATION AND ADMINISTRATION.	
The analysis of the work into its separate functions, and the development of a system of procedure to carry it into effect.....	21
CHAPTER III.	
PURCHASING.	
Details concerning the preparation of contracts for work or materials, and the Rules for purchasing supplies in order to obtain the right materials in proper quantities at the lowest price.....	31
CHAPTER IV.	
INSPECTION.	
The inspection of Supplies.....	58
CHAPTER V.	
STORAGE AND ISSUE.	
Fixing Stock Limits—Care of Supplies—Equipment of Storerooms—Rules for Storekeepers—Issues—Loans and Transfers of Supplies—Subsidiary Stores.....	63
CHAPTER VI.	
RECORDS AND ACCOUNTS.	
Information required for proper accounting control—The collection of data and the preparation of charts and diagrams.....	91



CHAPTER I.

SCOPE AND DUTIES

The work of the Bureau of Supplies and its relation to the rest of the organization.

When first formed, the Supply Bureau of the Department of Water Supply, Gas and Electricity was really a mere purchasing division doing a sort of commission house business, with no voice concerning the maintenance of stock, the quantity or quality of supplies bought, their inspection, storage, issue or accounting.

Realizing that this was wrong because it violated many fundamental rules of business management, an endeavor has been made to formulate the basic principles involved and then proceed accordingly. It is particularly necessary to consider these matters now that there is so much loose talk in favor of a central purchasing agency for the entire city.

First, it is essential to fix and determine the scope and duties of the Supply Bureau and its relation to the rest of the Department, that friction and conflicts of authority be prevented and that the work of the Department as a whole be done in an orderly and proper manner by those best capable of handling it. For instance, it should be settled where the functions of the Bureau using the supplies should best end and those of the Bureau doing the purchasing begin. To carry the inquiry further—who under varying conditions should originate requisitions for supplies and who should be permitted to amend or veto such requisitions? Previously, the other bureaus using supplies arbitrarily fixed their own stock limits, specified what they wanted, and then when the goods were delivered to them direct by the dealer who got the order, they often inspected them and assumed control over them till used.

It is assumed that the Department has or should have a definite program regarding all new work, improvements, standards of maintenance, and standards of operation, which will absolutely govern all its actions.

The establishment of such a program is a "staff" problem that should be developed and formulated by experts. It is based on the conditions to be met, the work to be done, and the funds available; and, having been

adopted, it should shape the activities of the Department for years to come. An absolute change in expected conditions, or unforeseen emergencies, are the only things that should effect any alteration in such a prearranged plan, for a carefully considered policy of this sort gives stability to a department and enables all work undertaken in accordance with its terms to be done under the most favorable conditions.

Such foresightedness on the part of all would lead to co-operation and team play between the different departments, and do away with present conditions under which one branch of the City's government puts down a pavement and another straight away comes along and rips it up to build a sewer or lay a water pipe.

The preparation of the contracts necessary to carry out this "policy," and the purchase of the required supplies are "line" duties. The scope of these duties is fixed by the "staff" policy, for no official would prepare a contract for which there were no funds provided, and no one would be permitted to veto a requisition for supplies when it was understood that it had been prepared in strict accordance with established standards and was for quantities which long study had shown to be absolutely necessary.

The sum total of Supply Bureau efficiency is ordinarily assumed to have been secured when

1. The Bureau itself is run economically.
2. The most reasonable prices are obtained for all articles purchased.
3. The articles called for and paid for are the ones delivered.

All these conditions may obtain and yet the service be poor, and the annual supply bills exorbitant unless the Bureau of Supplies sees that:

1. The supplies ordered and bought are really necessary.
2. The supplies specified and bought are those best suited to the use to which they are to be put.
3. The precise quantity needed is ordered.
4. Purchases are made in accordance with a definite plan and under most favorable market conditions.
5. The amount of money invested in supplies is kept at a minimum.
6. All supplies are properly stored and issued.
7. Supplies are only put to the use intended.
8. Supplies are used efficiently and economically.
9. Supplies are kept in service till they are worn out, or changed conditions require the substitution of a more efficient or economical article.
10. All burdensome and foolish restrictions and conditions are removed from the bidding requirements and the specifications.

1. All supplies ordered and bought should be really necessary.

There may be a great many reasons why proposed expenditure is not necessary. Perhaps there is a great surplus of identical stock in some store-room which is available, yet not used because there is no inventory to show its existence, or no system of stores control to ascertain the fact before going into the market for more.

It is for this reason that the Bureau of Supplies should have charge of all goods in storage, that it should be responsible for the inventory and that it should maintain a system of stores control.

2. All supplies specified and bought should be those best suited to the use to which they are to be put.

It frequently happens that large sums are wasted by calling for materials far too expensive and of too high a grade for the purpose intended. Again, it sometimes happens that poor material is bought because it is cheap, whereas a better and more costly article would have rendered proportionately far more service.

To obviate this, the Bureau of Supplies has set up standards and written specifications so that the most suitable supplies may be bought and the same article used for the same purpose throughout the entire Department.

3. The precise quantity needed should be ordered.

When a man leads a hand-to-mouth existence, continually ordering small quantities of material, he puts the purchasing division to a lot of expense, as it costs nearly as much to handle a small order as a large one. The cost of delivery is away out of proportion to the size of the shipment and the necessity for inspecting each lot increases inspection costs.

On the other hand, when told to do a piece of work most men "get on the safe side" and order far more material than close figuring would show to be necessary. This is particularly true where the machinery of purchasing is cumbersome. A man hates the bother of making out another order for additional stock. If more material has to be purchased and there is much red tape he may have to wait a long time, and the job will be delayed.

Quantities should be checked and men held responsible for extravagant requisitions. Before the Bureau of Supplies was created it had often happened that great over stocks were purchased because the individual ordering did not understand conditions. Interest on investment, depreciation and other losses made this an expensive way to do business.*

4. Purchases should be made in accordance with a definite plan and under most favorable market conditions.

It frequently happens that a half dozen requisitions to purchase some standard material are sent in one at a time during the course of the year as

* One instance recently came to light where a sufficient quantity of a certain unimportant commodity had been bought to last the entire Department for twenty years at the present rate of consumption.

the various projects develop on which the material is wanted. Ordering supplies in this manner is unsatisfactory. It greatly increases the office expense for purchasing, it prevents the combination of similar requisitions in order to obtain wholesale prices, and the fact that immediate delivery is generally demanded makes it impossible to wait for favorable markets before buying.

One improvement is that a large proportion of the supplies now bought are ordered in advance and instead of being delivered direct to the consumer, are consigned to the nearest storehouse, where they are inspected and stored and later delivered from stock as called for on requisition. In this case the stores act as distributing depots.

On the other hand, if the Bureau of Supplies could stop doing business on a "commission house basis," much further good would result. The Chief of the Bureau should be consulted in conference by the other bureaus—and should be thoroughly informed concerning all proposed undertakings—a policy which has been strongly advocated. He would no longer wait till notified of the immediate need of materials before purchasing them, but would anticipate the future requirements of the department and prepare a material budget to supply them.

It would then be the duty of the Bureau of Supplies to keep in its storerooms a stock of various standard goods which it could issue immediately on requisition. The storerooms would then fulfill their proper function by being real collection or storage depots.

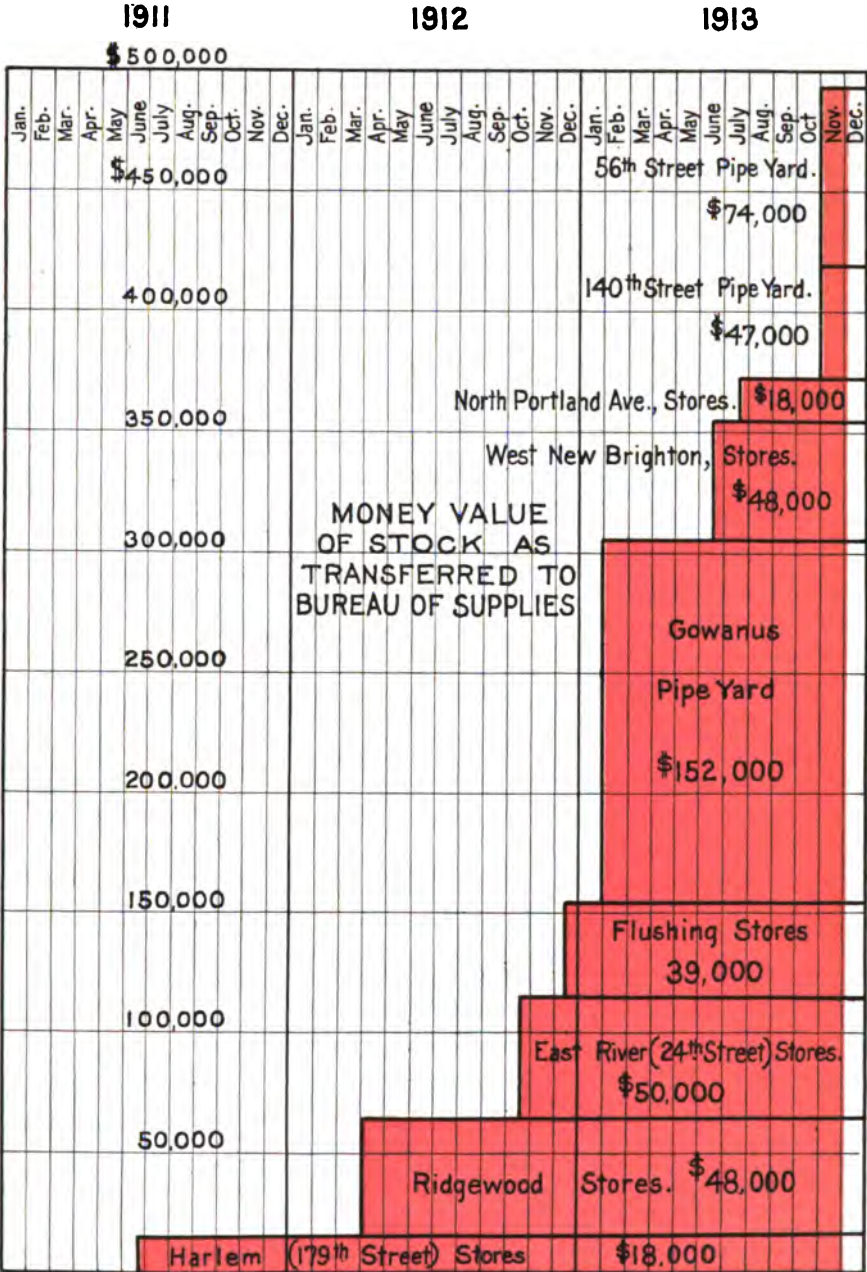
5. The amount of money invested in material should be kept at a minimum.

Fixing the limits of stock to be carried is most important and is treated in detail in the chapter on Storage and Issue. It is pertinent to indicate here while discussing the relations of the Bureau of Supplies to the rest of the Department, that in order to know the proper amount of stock to keep on hand, the Chief of the Bureau of Supplies should be in close touch with the work of the Department as a whole, and with the details of that "program" so often before referred to, which is supposed to regulate all activities. He should know of all new work and all contemplated improvements a sufficient time in advance to purchase the required supplies in a favorable market, and to have them delivered, inspected and ready when needed. He should be informed concerning the amount and nature of materials necessary to be kept in reserve at certain points for various emergencies. He should be fully posted regarding the stores required for current operating purposes, and any changes in "policy" which will affect the same.

Using these facts in connection with the data on the time required to obtain or replenish stock by purchase or transfer makes it easy to calculate the minimum quantities of stock to be kept in storage.

The question of the proper amounts of emergency equipment, spare parts, tools, implements and current supplies to be maintained by the opera-

GROWTH OF THE STORES SYSTEM UNDER THE BUREAU OF SUPPLIES.



ting divisions is most important though apparently it has not yet been standardized.*

6. Materials should be properly stored and issued.

It has always been considered a grave error in organization to place the control of materials and supplies (in large quantities) in the hands of the men who use them. The Bureau of Supplies has insisted that it should store all materials and supplies prior to issue, under the care of responsible men especially detailed to that work. With this end in view, it has always assumed charge of storage points whenever permitted to do so and the accompanying chart graphically shows the growth of its responsibilities in this direction. The economy in consumption and diminution of waste effected by this control has been remarkable.

The previous improper methods of storage and accounting for supplies have become apparent as the various storage points have been placed under the jurisdiction of the Bureau of Supplies.†

Rules for the care and storage of supplies after issue from stores and while in the hands of the ultimate consumers, should be prepared and enforced.

7. Supplies should be put only to the use intended.

This is a matter only partially within the control of the Bureau of Supplies. Purchasing Agents can assure themselves that goods bought are suitable for the requirements, and storekeepers can report when goods requisitioned out of stores are not suited to the ostensible use to which they are to be put, as stated on the order. They can also prevent deterioration in stock and loss from theft which certainly do not come under the head of "use intended." Beyond that they cannot go, though branding and marking stock is perhaps a further safeguard.

There should be inspectors, operating along the lines of the Inspector Generals Department of the regular army, whose duty it should be to investigate and see that stores once issued are put to the proper use.

8. Supplies should be used efficiently and economically.

No matter how careful and saving the Bureau of Supplies may be in the matter of purchase, inspection, storage and issue of supplies, if the men

* The Navy Department specifies the amount of ammunition for the various guns to be carried by the warships of the different classes—just, for instance, as it definitely states the number of launches, whaleboats, cutters and so forth to be carried by each type of ship—and then further goes into detail regarding the number of oars and other articles of equipment, such as masts, sails, tiller, and compass, that each of the small boats must have. In this manner the exact quantity of stores and equipment for every pumping station, repair company or other point under the control of this Department should be established.

† In one case, cement in bags had been stored on the earth floor of a barn cellar, where it had been flooded and destroyed; in another case rubber goods had been placed next to steam pipes and ruined; again, hydrants were stored in a pipe yard so that they filled with water. This was discovered just before the first hard frost of the season otherwise they would have burst.

using the material use it inefficiently or wastefully it will soon give out and have to be replaced, with the result that the cost of supplies to the Department (and thus to the taxpayer) will be high.

Again we have a condition beyond the jurisdiction of the Bureau of Supplies as now organized, yet vitally affecting the amount of supplies which have to be bought.*

9. Supplies should be kept in service till they are worn out, or changed conditions require the substitution of a more efficient or more economical article.

Loss is often incurred by premature replacement of materials. To the cost of the new article must be added the cost of the replacement plus the remaining value of the article replaced, which can seldom be used elsewhere.

10. All useless, burdensome and foolish restrictions and conditions should be removed from the bidding requirements and the specifications.

The City's business should be made as attractive to possible bidders as is that of any of the great private corporations. On the contrary, doing business with the City is now fraught with many needless annoyances and restrictions. Many of the conditions so imposed cause the contractor actual expense, while others merely introduce elements of uncertainty and possible loss against which he must protect himself by increasing his bid proportionately. All such obstructions, whether actual or potential, are ever present handicaps to proper economy.

Some of these conditions are imposed by law; others are the result of bad purchasing methods, improperly worded specifications, inefficient office procedure or conduct of employees.

It is foolish to imagine that the lowest possible prices have been obtained merely because the letting was public, bids being taken, and the award made to the lowest bidder; for many may not have bid who otherwise would have been glad to put in a price, and others who did bid might have bid lower.

A detailed study of these matters will be found in the chapter on Purchasing.

Board of Survey.

The disposition to be made of excess stores or equipment and obsolete or damaged material constitutes the one remaining point where the activities

* As an example of this point, how is money to be saved by the best of coal specifications, by payment on the B. T. U. basis (for the *heat* the coal can give, not for its weight), by well advertised competitive bidding, and by careful weighing, inspection and analysis of coal delivered, if the coal so bought is wastefully burned under the boilers? If coal is badly stoked so that much of its gases go up the chimney unconsumed as smoke, if a stack temperature twice what it should be indicates that the blowers are rushing the gases through the boilers and away to waste, before the boilers have had a chance properly to abstract the heat from them, or yet again, if an analysis of the ashes shows a great amount of unburned carbon, all savings in purchasing will be neutralized.

of the Bureau of Supplies are so closely related to those of other branches of the Department that friction has often resulted.

This work can best be done by a Board of Survey, consisting of an official of the Bureau of Supplies, and a "staff" engineer. They should periodically inspect and survey all stores, equipment, engine spare parts or other supplies owned by the Department for the purpose.

1. Of condemning (and ordering to be sold) all
 - (a) obsolete material
 - (b) damaged material not fit to be repaired.
2. Of ascertaining whether such material as may be damaged or worn is worth repairing, and, if worth repairing, directing that said work be done.

Method of Financing the Work.

The work of the Department, particularly the letting of contracts and the purchasing of supplies is very much hindered by the way funds are appropriated. First there is a segregated budget, later an apparently unlimited transfer of funds is permitted.

NEW WORK RECOMMENDED.

The preparation of a Material Budget.

The organization of a Systematic Inspection of Departmental Supplies by a Board of Survey.

Separate treatment for issues of Consumable and Non-consumable materials.

The adoption of a Cheaper Distributing System.

Auto-trucks for deliveries from Storerooms.

Investigation and Study of Supply Prices.

Method to Prevent Unbalanced Bidding in Contracts, as is now done on Open Orders.

Completion of Storeroom at Ridgewood and at Other Points.



PHOTO. 1.—OLD STOREROOM AT 179TH STREET PUMPING STATION IN USE
PRIOR TO ESTABLISHMENT OF BUREAU OF SUPPLIES.



**PHOTO. 2.—NEW STOREROOM AT 179TH STREET—THE FIRST OF THE NEW
GENERAL STOREROOMS EQUIPPED AND OPERATED BY THE
BUREAU OF SUPPLIES.**



PHOTO. 3.—OLD CONDITIONS AT "HARLEM STORES."
(Kerosene oil and cotton waste stored side by side! Floor covered with pipe.)

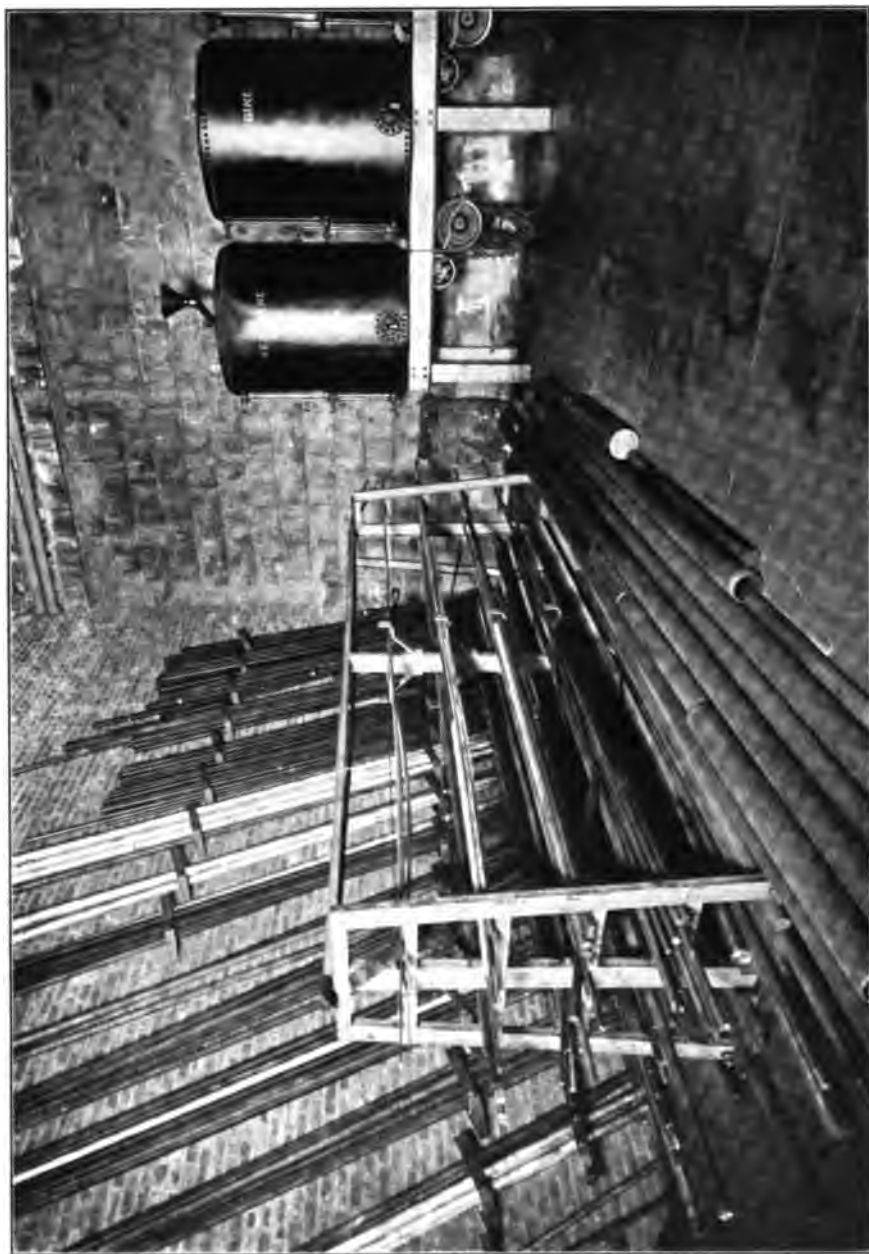
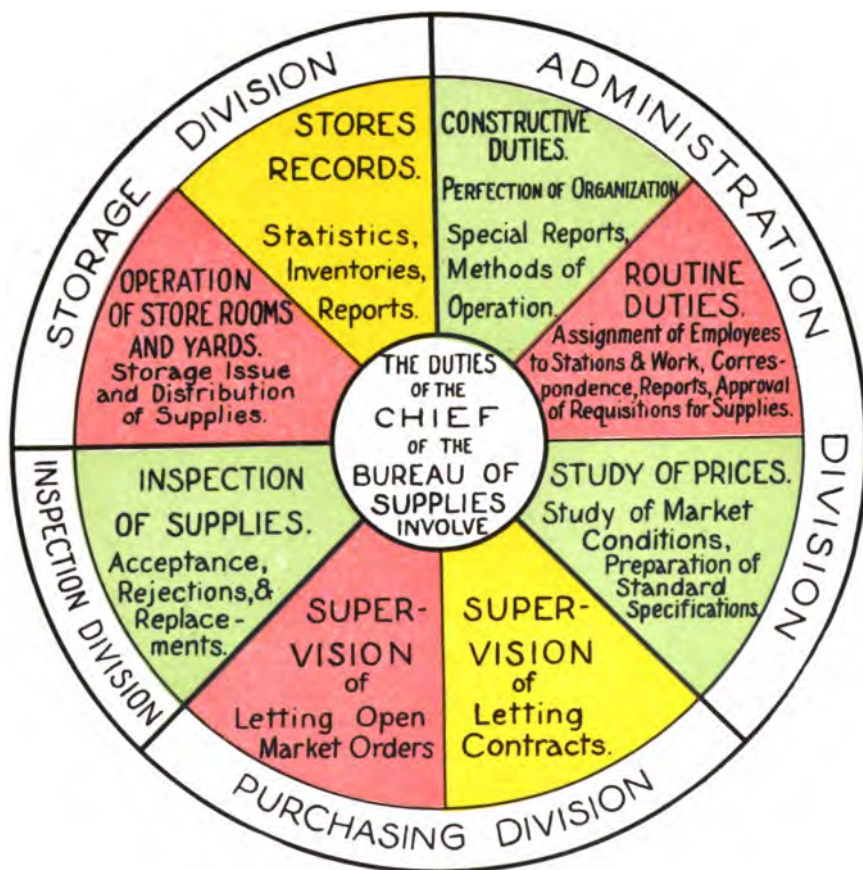


PHOTO. 4.—PRESENT CONDITIONS AT "HARLEM STORES."

(This is the same room shown above. Combustible materials no longer stored with kerosene. Floor space saved by storing pipe in new rack against the wall.)



CHAPTER II.

ORGANIZATION AND ADMINISTRATION

The analysis of the work into its separate functions, and the development of a system of procedure to carry it into effect.

Several things require attention when taking hold of a new problem. First, the nature of the work must be investigated and the general question settled concerning what is to be done. Then the details of the plan for carrying these ideals into execution must be formulated—that is Organization. The doing of the work according to such plans is Administration or Operation.

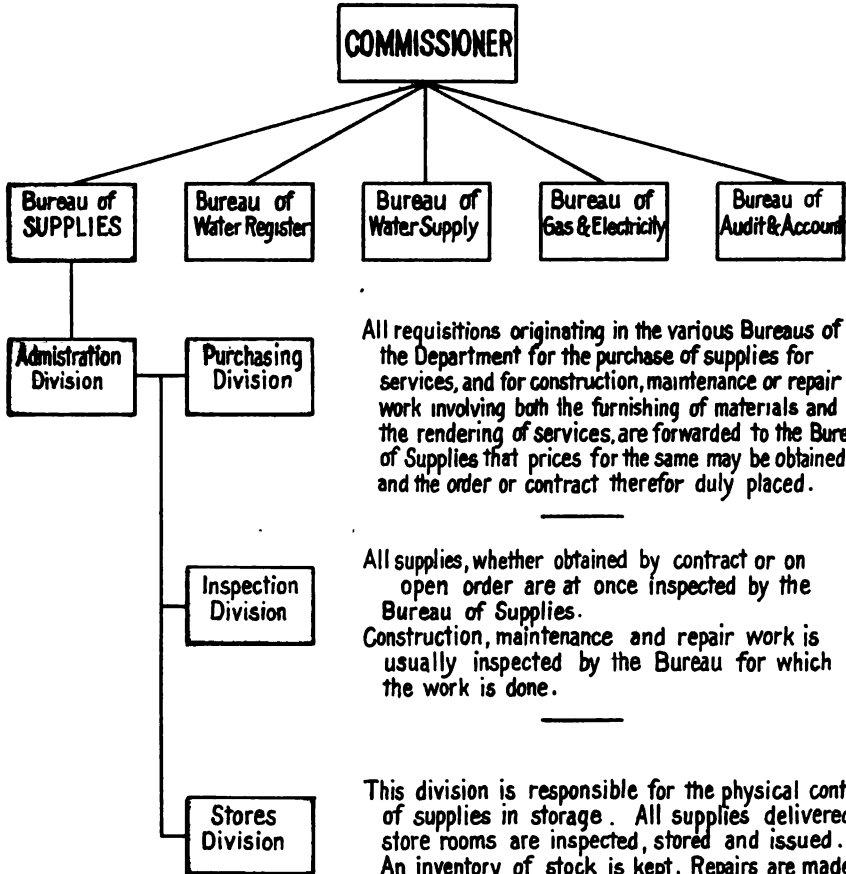
It should be clearly understood that the study of the situation, the planning of the work, and the organization of the Bureau of Supplies was a constructive problem; whereas the operation of the Bureau in accordance with the principles thus formulated is a routine or administrative matter.

Conditions Governing the Reorganization.

The first problem in the organization of the Bureau of Supplies concerned the internal affairs of the Bureau itself, the object being to systematize and direct the work so that it might be done correctly at the least cost. The Bureau of Supplies purchases, inspects, stores and issues all materials used by the Department and lets all contracts for work done and services rendered, thus dealing with the most vital functions of a going concern whose operation could be neither stopped nor delayed. All changes had to be so made that they would not interfere with the work. The pumping stations had to have coal and oil even though the specifications for coal and oil were not perfected; nor would the lack of a general stores control system have excused withholding supplies from a pumping station simply because the need for them had not been investigated.

Another element which complicated the situation was the fact that the time for carrying the reform into effect was limited, so it was necessary first to remedy those matters which involved the largest expenditures or the greatest amount of waste.

FUNCTIONAL ORGANIZATION CHART, BUREAU OF SUPPLIES.



All requisitions originating in the various Bureaus of the Department for the purchase of supplies for services, and for construction, maintenance or repair work involving both the furnishing of materials and the rendering of services, are forwarded to the Bureau of Supplies that prices for the same may be obtained and the order or contract therefor duly placed.

All supplies, whether obtained by contract or on open order are at once inspected by the Bureau of Supplies. Construction, maintenance and repair work is usually inspected by the Bureau for which the work is done.

This division is responsible for the physical control of supplies in storage. All supplies delivered to store rooms are inspected, stored and issued. An inventory of stock is kept. Repairs are made. Scrap is sorted and worthless materials are sold. Materials are transferred from one storeroom or storeyard to another as the needs of the Department may require. The storerooms act as distributing centers, and local deliveries are made by automobile trucks.

Functional Organization.

The work was mapped out, the various duties being classed according to their nature into Purchasing, Inspecting and Storage and Issue of supplies. A diagram of the organization was prepared and the duties of the personnel assigned in accordance with these functions.

Standardization of Procedure.

Conditions and procedure were next standardized so that work was no longer done in a haphazard manner or left to chance.

All steps in every activity of the Bureau were studied and instructions were prepared showing:

- What work was to be done.
- How the work was to be done.
- Where the work was to be done.
- When the work was to be done.
- Who was to do it.

These standard practice instructions systematized and simplified the routine of the office so that it could be carried on by the fewest possible number of employees and in the least time. To instruct employees concerning what they have to do, and how they are to do it, not only prevents conflicts of authority, but fixes responsibility and shows whether or not the work is being attended to.

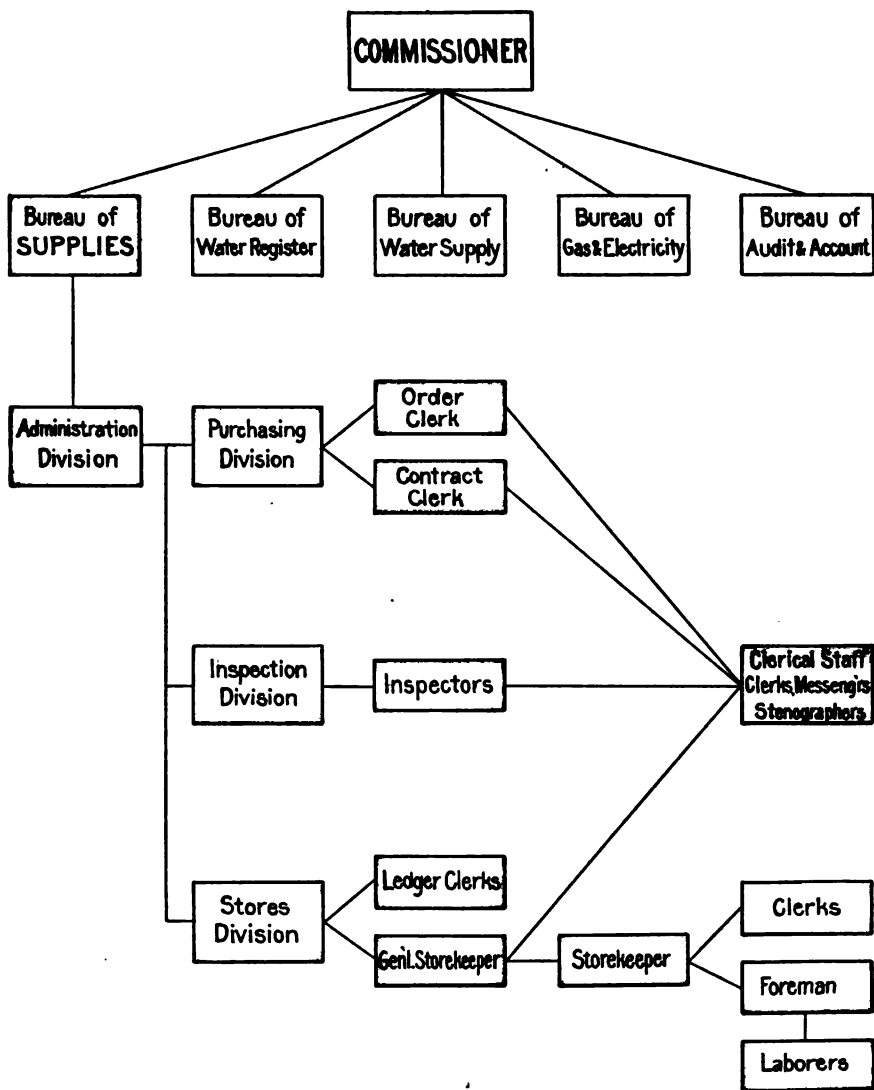
The routine has been made as simple and as flexible as possible. The magnitude of the business makes it impossible for the men at the head to keep familiar with all details; subordinate officials are trained to assume responsibilities within their grasp. Though the line of authority is strictly maintained and orders are given in accordance therewith, all employees are expected to co-operate and furnish information and assistance to one another whenever possible.

The philosophy of the arrangement has been:

- First—To standardize the routine work so that it becomes practically automatic.
- Second—To place responsibility for details with men having sufficient time and first hand knowledge of the facts to pass upon them.
- Third—To release the men, who by reason of experience, knowledge and skill, are at the top of the Bureau, from functional activity so that they are free for the larger creative and administrative duties.

At the beginning of the present administration, the departmental units in the various boroughs obtained prices for supplies separately, and in order to obtain greater efficiency, this work was concentrated in one central office. This resulted in a slight reduction in the force, tending to unify the

ORGANIZATION OF PERSONNEL, BUREAU OF SUPPLIES.



organization and give better control. The values of centralization, however, were not alone brought about by locating all employees doing similar work in one office; the main advantage lay in the opportunity to improve upon the old methods in which requests for purchase of supplies were prepared in the various boroughs without knowledge of standards or of stock possibly on hand elsewhere; and in which these individual requisitions were handled separately, and consequently uneconomically.

The concentration of goods on hand was next undertaken and store-rooms were fitted up at central locations where supplies could be conveniently delivered, promptly inspected and properly stored, issued and accounted for.

Training the Employees.

Training the employees was next undertaken. It is all very well to study conditions and develop the most scientific and efficient procedure, yet without the intelligent co-operation of the men required to carry it out, progress will be slow. They must be instructed in their duties—they must have explained to them in detail what is expected to be done and how and when and where and by whom. They must be “coached” with the same care and thoroughness that is used with the members of a professional ball team, a college crew, or the detail working of a coast defense gun. It calls for much persistency, for old habits must be broken before new ones can be acquired, and the men must be tried at this and at that to see where they best fit in, as a man can only do his best work when adjusted to the organization. Alas, some men do not appear to be much good anywhere. Military discipline is very necessary but most difficult to obtain where the man in charge lacks the power of the “bounce.”

It is necessary that there be no “indispensable men.” Such ones are the most dangerous units in any organization, for sooner or later they are taken sick or die, or get a better position elsewhere, and the work suffers since they were “indispensable,” and there is no one prepared to take their place. There should be one or more men regularly trained as “under-study” for every position.

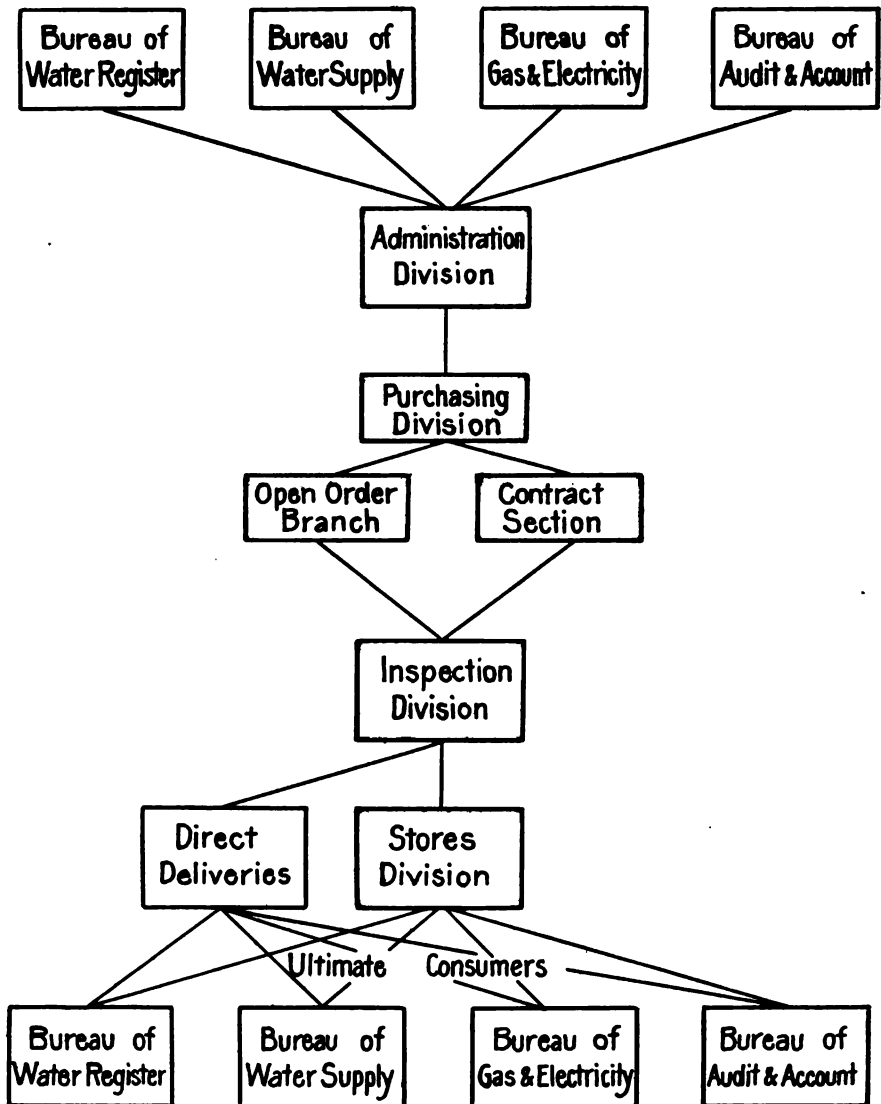
Only the most incompetent object to this policy after it is explained that the “indispensable” man stands in his own light as regards promotion and advancement, for with no one fitted to take his place he must perforce be left in it, and some other man given the coveted vacancy higher up, when such occurs.

Besides making the force adaptable, such training tends to make a man do his own particular duties better and more intelligently since he sees their relation to the work as a whole. It gives him interest and it enables him to suggest improvements of value where other branches of the work touch his.

Furthermore, careful observation of the men during the periods when they are being trained and “tried-out” in the different positions affords

BUSINESS PROCEDURE, BUREAU OF SUPPLIES.

Main Steps Between Receipt of Requisition and Delivery of Goods.



excellent opportunities to study their capacities and abilities and to finally assign them where they will be most effective.

Improved Conditions.

The old conditions under which the office work was carried on were most unsatisfactory. The clerks faced a low railing which separated them from the space where the public came to make inquiries and transact business. This resulted in constant interruption of the work. The office arrangements were shifted, one of the changes being that the desks were turned away from the public and faced toward the wall. Further to save the time of the higher paid clerks, all telephone calls and all personal inquiries of individuals were first answered by a boy who found out what was wanted; and in the majority of cases was able to attend to it himself without interrupting the other men.

Wherever roll top desks were found, flat top desks were substituted, and four-legged cane-bottom chairs took the place of the swivel and padded variety.

The space allotted to the storage of goods was fitted up to best serve the purpose. Bins were especially designed and were built to hold the particular kind and quantity of goods to go in them.

System and standardization has been extended to all devices used for keeping the office records; and the new forms, ledgers and cards that have been introduced are a vast improvement over the miscellaneous collection of papers which they superseded.

It is clear that all business must keep records of its activities and transactions, but beyond that point ideas are often vague or at variance. The nature, extent and character of the statistics best suited to the problems in hand have received much study. So truly do "circumstances alter cases" that any attempt to take the forms and blanks of some railroad or other corporation and graft them bodily upon a different business is foolish. It is as if the Republic of Hayti should solemnly adopt the Revised Statutes of the United States and enact them as the law of their land, expecting in consequence immediately to enjoy a similar government. Improvements are not accomplished that way. Even with the best of systems, specially designed to meet the needs of any business, the personalities of the men in charge are the governing factors.

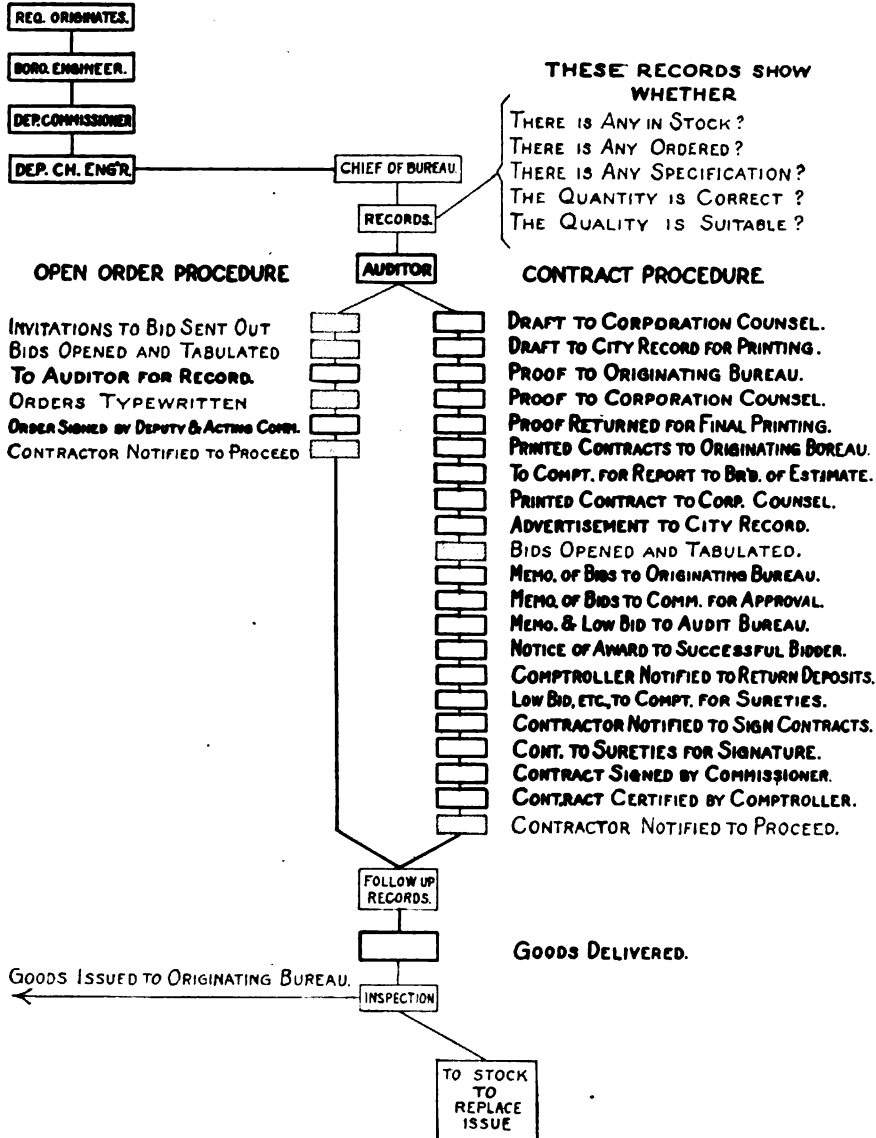
A great deal of the work has been pioneering, for there is but little information available to guide in formulating the philosophy underlying such an undertaking. Still less is there to guide one when it comes to the carrying of it out. Many a promising experiment gave unsatisfactory results. But then the Chinese Navy is the only one that never has any accidents—for it never goes to sea. Mistakes often occurred, as was to be expected where new methods of doing business were being developed, but the same mistake seldom occurred twice.

There is much general misunderstanding concerning city purchasing methods. Section 419 of the Charter says:

“ Whenever any work is necessary to be done to complete or perfect a particular job, or any supply is needful for any particular purpose, which work and job is to be undertaken or supply furnished for The City of New York, and the several parts of the said work or supply shall, together, involve the expenditure of more than one thousand dollars, the same shall be by contract, under such regulations concerning it as shall be established by ordinance or resolution of the board of aldermen, excepting”

The respective procedure for both Contracts and Open Orders is illustrated on Chart opposite. It is instantly seen that the letting of a contract is a complicated matter, as the papers must be referred to many different officials and passed upon by them. The aggregate time thus consumed is great, therefore contracts cannot be used to purchase supplies needed immediately or to do work which is urgent. This is one of the reasons that open market orders are of necessity so frequently resorted to.

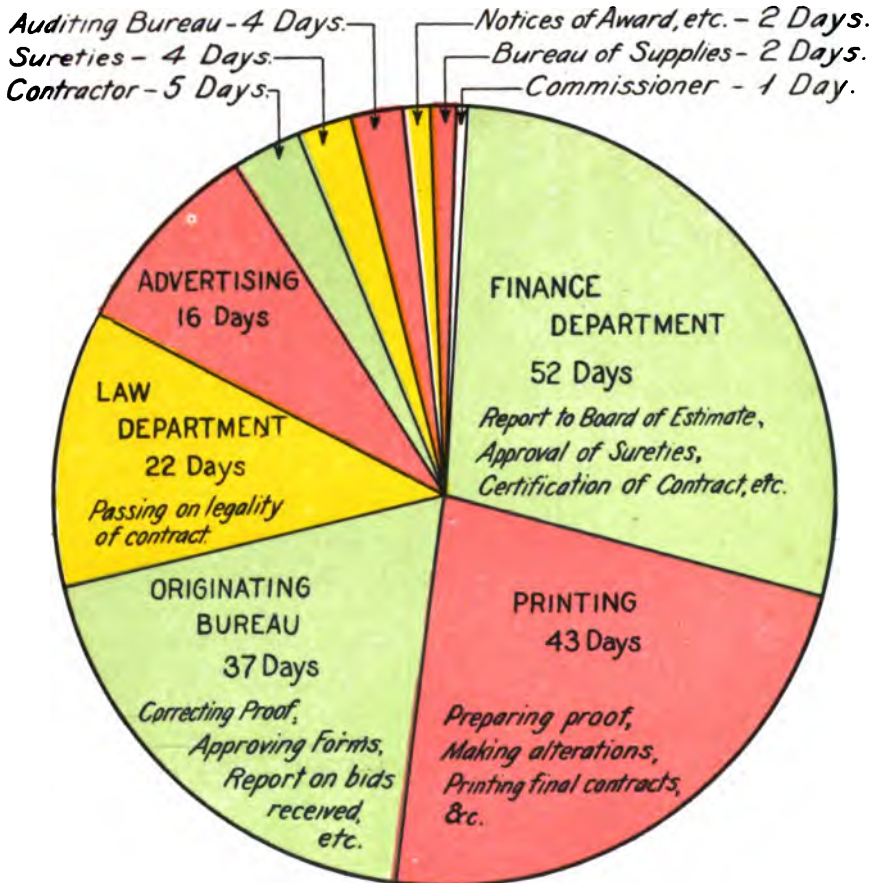
PROCEDURE CHART.



- ☐ ACTIVITIES NOT UNDER THE BUREAU OF SUPPLIES
- ☐ WORK DONE BY THE BUREAU OF SUPPLIES.

TIME REQUIRED TO LET A CONTRACT.

Aggregate 188 Days.



This chart is based on a study of twenty different contracts and gives the average amount of time taken by the various steps of the present procedure from the receipt of the draft of the contract (plans, specifications, etc.) by the Bureau of Supplies to the notice to the contractor to begin work.

The Bureau of Supplies has been able to expedite the work in many instances by filing duplicate copies of certain papers with two or more officials simultaneously. This saving averaged sixteen days, thereby reducing the average total time to one hundred and seventy-two days.

Some contracts, such as those for the purchase of coal and other supplies, are made up on a blank form of standard contract, whereby certain of the preliminary steps of the contract procedure become unnecessary. In consequence they may be and are let in much less time.

CHAPTER III.

PURCHASING

Details concerning the preparation of contracts for work or materials—and the Rules for purchasing supplies in order to obtain the right materials in proper quantities at the lowest price.

The Bureau of Supplies lets all contracts for the purchase of material, and for the doing of work and the rendering of services. When the present reorganization began two years ago, its share in these activities was much restricted, in fact it merely acted as agent for the other Bureaus, and bought what it was told to buy; or contracted for what it was told to contract for, in a purely mechanical way. It was assumed that all work ordered was really required and that all supplies requisitioned were necessary and were correct as regarded quality, quantity and suitability for the use intended. Furthermore, it was taken for granted that the specifications furnished the Bureau of Supplies not only described the work to be done or the material to be furnished in a proper manner, but that they were so worded that the work could be done economically and the supplies furnished at rock bottom prices. This was not so.

The cost of construction and the time it takes not only depend on the extent and nature of the undertaking, but are largely affected by the conditions under which the work is to be done, and the specifications governing it. Every large contract raises the question whether it is better to let the work as a whole or in parts. If the former method is adopted, the subsequent work of the department is simplified because there is but one party to do business with, and responsibility is easily placed. On the other hand, when the work is let in parts, competition is extended, as many bids will be received from individuals or firms unable to undertake the entire project, yet able and desirous of bidding on part of it.

Another most important question concerns the advisability of taking bids on the basis of a lump sum for the whole work, or requiring the bidder to state the unit prices for which he will do given quantities of work, as so much per cubic yard of rock excavation, or per cubic yard of concrete, or per square yard of street paving. The former method involves the question of extras, the latter generally results in unbalanced bidding, unless steps are especially taken to prevent it.

These and many other matters of like nature are questions of policy directly affecting the cost of construction.

Specifications, too, play their part in affecting prices. The general clauses (those which describe the work, fix the times of commencing and finishing it, set forth the terms of payment, define the contractor's duties and his liabilities, state the manner in which plans shall be interpreted or disputes settled, and appoint the conditions governing the conduct, maintenance and completion or abandonment of the contract), are no less important than those special clauses which supplement the maps and drawings and indicate in detail the quality of the materials to be used or the methods to be employed.

All this, however, has not fallen within the province of the Bureau of Supplies, either to praise or blame. Time was limited, and the activities of the purchasing division have been concentrated on that no less interesting problem of developing a correct buying policy—a "Philosophy of Purchasing Supplies," if you please—and then putting it into effect.

"Philosophy of Purchasing Supplies."*

Two questions present themselves to every man who would introduce new and efficient methods in any branch of business.

The first matter to be determined is:

What work is to be done?

and the second:

How is it to be done?

It took much study to ascertain and formulate the fundamental principles of correct purchasing which are the answer to the first question, but once determined they proved to be quite simple. They may be concisely stated thus: *Get the right materials in correct quantities at the lowest price.*

These ideals have been the foundation on which the new purchasing methods of this Department have been built. They involve much more than the mere filling of such requisitions as are sent in; the lowest price being assumed to have been secured because the bidding was competitive. Such procedure is merely doing a commission house business. When a requisition is filled according to its terms there is no assurance that the goods called for are those best suited for the purpose for which they are to be used, that the quantities called for are reasonable, or, finally, that the articles ordered are so specified that standard prices can be obtained.

The answer to the second question, "How is the work to be done?" is found in the detailed matters of policy that have been developed and the rules and regulations that have been written down to carry them into effect. These methods of procedure will be considered in the order in which they relate to the purchasing sequence of right materials, correct quantities and lowest price.

*This was the title of a paper presented by the author at the Thirty-second Annual Convention of the American Water Works Assn. at Louisville, Ky.

RIGHT MATERIALS.

The duty of always purchasing the "right materials" is the most important and difficult that confronts the purchasing agent. The right material does not necessarily mean the best grade of stock in the market, neither does it mean the cheapest that will suffice for the purpose. White pine is better than spruce, yet white pine is not the "right material" with which to build temporary shelves; engines can be run with a cheap oil, yet a cheap oil is not the "right material" with which to lubricate expensive engines, for the extra cost of repairs to the engines will offset a thousand times the saving in the cost of the oil.

The "right material" is the material most suitable to the purpose for which it is intended and containing the greatest units of value (service) per unit of cost.

This is a very approximate definition and requires careful explanation. Goods to be suitable must not always be merely reliable under ordinary conditions, they must often be dependable under special conditions. A hose which *might* burst would be perfectly satisfactory for flushing the streets, but it would not do for fire service.

The term "units of value" (service) must needs be amplified. One often hears the expression: "It costs a little more, but it will wear twice as long." The "wear" represents the units of service.

One oil is cheaper than another, yet perhaps it takes twice as much of it to accomplish the same result. One grade of coal is cheaper per ton than another, yet the freight cost of the inferior fuel is the same as on the better one, while the possible necessity of requiring a blower to burn it, and the cost of the extra fire room force for stoking and handling clinker and ash sometimes make the cheap fuel an expensive economy.

Also it generally does not pay to expend good labor on poor material. The cost of carpenter work on poor lumber is as great as on good stock. People often fail to consider the small part the value of the materials in a finished article bear to the larger costs of labor, overhead, etc., required to produce it.

Not only must the cost of the supply itself be taken into account; the cost of placing the supply in operation is also a factor of the situation. It is easy to realize that some materials might be of such poor quality that, even if they were to be obtained for nothing, one could not afford to use them, because the cost of frequent replacements would outweigh the saving in price on the article replaced.

Standardization of Materials.

It has therefore been one of the first and most important duties of the Bureau of Supplies to determine the various grades or qualities of materials which will be furnished for specific purposes.

This work should be done more extensively, and with the hearty consent, advice and co-operation of the other Bureaus concerned.

Multiplicity of styles and types of stock is a costly nuisance and a serious disadvantage. It necessitates unproductive investments in stock, it increases costs of storage and supervision, and leads to mistakes, confusion, and loss of time in making issues. A list containing all the various items regularly requisitioned, and in current demand, should be prepared. These items should be considered with regard to their cost, nature, composition, wearing power, keeping qualities, and the conditions under which they are to be used. The prevailing practice at the present time consists in having the man who is going to use supplies make out an order for the quantity and quality that he wants. This order is forwarded through various officials in his Bureau and is finally passed on to the Bureau of Supplies for them to make the purchase. Such procedure is all wrong.

In the first place such methods often result in men in the class of laborers being the ones who ultimately settle on the quality of materials ordered. Contrary to prevailing opinion, workmen who use materials themselves seldom order what is best suited to their conditions. They are particularly open to influence by salesmen or agents and generally order by some trade name, with very little idea of the article's real merit or those of its competitors. The preparation of specifications for supplies is a "staff" matter, requiring the thought and attention of high grade men. The careful measurements of the testing laboratory and the precise and exact experiments of the chemical laboratory should be the guide to the writer of specifications rather than the (generally biased) opinion of some subordinate official in the operating department. The shape and size of shovel best suited to certain coal, the proper type wheelbarrow for moving ashes, the most durable variety of broom, should all be determined by the tests of experts. And what is more, these tests should be made and these questions ascertained. The "right material" should be selected in every instance and its use made mandatory. Even the fittings and equipments should be standardized.

It is of prime importance to have all equipment of similar nature interchangeable. If this were done, the number of spare parts necessary to maintain an adequate reserve would be comparatively few. If stations are equipped with valves and fittings of different sizes and dimensions (distance between faces of the flanges, etc.), similar special stock made only by the same manufacturer will ever after be requisitioned for all replacements at such points, on the ground that goods of another make having different sizes could not well be used. This stifles competition.*

The standardization of supplies has many other important features

* In this particular the adoption of standards for the Department—such as those recently agreed upon by the Master Steam Fitters' Association, the American Society of Mechanical Engineers and the Heating and Ventilating Engineers in the "U. S. Standard Schedule Requirements"—would effect a great simplification and improvement over existing conditions.

besides having experts determine what material is best to use for any given purpose.*

The standardization of supplies simplifies the work of the man ordering supplies, as it merely becomes necessary for him to refer to the number of a specification instead of preparing a long written description (often accompanied by drawings) of what he wants every time he wants it.

Standardization of supplies reduces the office work of the Purchasing Division and should enable the same number of clerks to transact more business in less time.

Standardization of supplies is of great value in reducing costs inasmuch as it permits the combination of various requisitions for the same material and the purchase of the lot at one time at wholesale rates.†

Standardization of supplies reduces the labor connected with making inspections and expedites such work.

Standardization of supplies permits great improvement to be made in the storekeeping system. It means less money invested in stock, less stock to be stored and looked after, and less paper work in connection with stores records, inventories and reports. The stock on hand moves faster and there is less loss from depreciation, or of stock becoming obsolete.‡

In the absence of such standardization, there is a tendency to order the highest grade obtainable when the goods are not to be paid for by the man doing the ordering. This habit of ordering goods of far higher grade than

* Men ordering material often have very hazy ideas concerning what they want, as letters on file in the Bureau of Supplies will show. The following are extracts from letters written to get adequate information on which to make purchases:

"SIR—I notice among the articles called for by you are six 25-foot lengths 2½-inch hose. Please state whether the hose required is water, steam or suction hose, also what specifications are to be used."

"SIR—In order to prevent further misunderstanding, it is desirable that quantity and quality of articles to be delivered should be definitely stated. Your requisition calls for 5 rolls of two-ply tar paper, without stating the number of feet or yards in each roll; it also calls for one keg of roofing cement without stating the number of pounds said keg is to contain. These are merely cited as instances."

"SIR—Under the heading of Metals and Alloys, sheet brass is ordered and its thickness is stated to be of a certain gauge. There is no universally accepted standard gauge, and therefore, the engineer should state whether he desires Birmingham or Brown & Sharp gauge. We buy sheet brass by the pound, so it is necessary to know the weights of the sheets as well as their size for bidding purposes. Information should also be furnished as to whether soft, hard or spring brass is desired. Roofing tin is called for, but no specifications have been submitted; nor have we any. It is necessary that the number of tins to the box, the size and quality be mentioned * * *."

† Ordinarily, every man running an engine has some favorite boiler compound which he has always ordered. Though many stations drew feed water from the same source, their various requisitions were different and could not be combined. When the water was analyzed by one of the Department's chemists and the proper compound for that water determined, the various requisitions could be combined and a large amount of the proper material for all the stations purchased at one time.

‡ Stock should be ordered with an eye to its greatest usefulness. Thus spiral and coil packing should be used as far as possible in preference to ring packing, for "½-inch spiral" will perhaps fit a dozen different piston rods of various diameters carrying a ½-inch packing space, and as packing is a supply that deteriorates the spiral and coil packing will be in constant demand and none will be left on the shelves.

is warranted by the use to which they are to be put is often traceable to the fact that men seem to feel that it relieves them from responsibility for any possible failure of the article when in service. Generally, however, it is plain extravagance.* Whatever its cause, it is an expensive habit, and the present method of the Bureau of Supplies is (except in rare cases) to fill all requisitions with articles of standard commercial grades and to enable this to be done the new forms of requisitions require a statement of the specific use to which the articles are to be put.†

Another tendency of men who write requisitions for which they do not pay out of their own pockets, is to prepare some special design that suits their fancy‡ rather than order standard ready-made articles. Men seem particularly prone to do this, especially if they can call on the services of a departmental carpenter to carry their plans into effect.

If requisitions for unusual materials or for articles of special design can be eliminated, and standard materials for the same purpose purchased in their place, a large saving in cost can generally be effected.

There are many circumstances when materials of even the highest quality are none too good, particularly so where the cost of replacement is high compared to the cost of the article; or where any failure on the part of the material in service might result in serious consequences. This not alone refers to accidents resulting from defective materials (often the result of poor inspection), but to those conditions where reliability is of the very utmost importance. Supplies purchased for the high pressure fire service may be taken as examples. Everything connected with the system must be of such excellence that the pumps can be depended on to operate without hitch whenever needed for as long a period as necessary. Similarly steamship engineers not only demand supplies of the first quality, but at the end of every run they overhaul their engines and equipment and replace many an article capable of giving still further service, in order that the possible necessity of stopping to make repairs at sea may be reduced to a minimum.

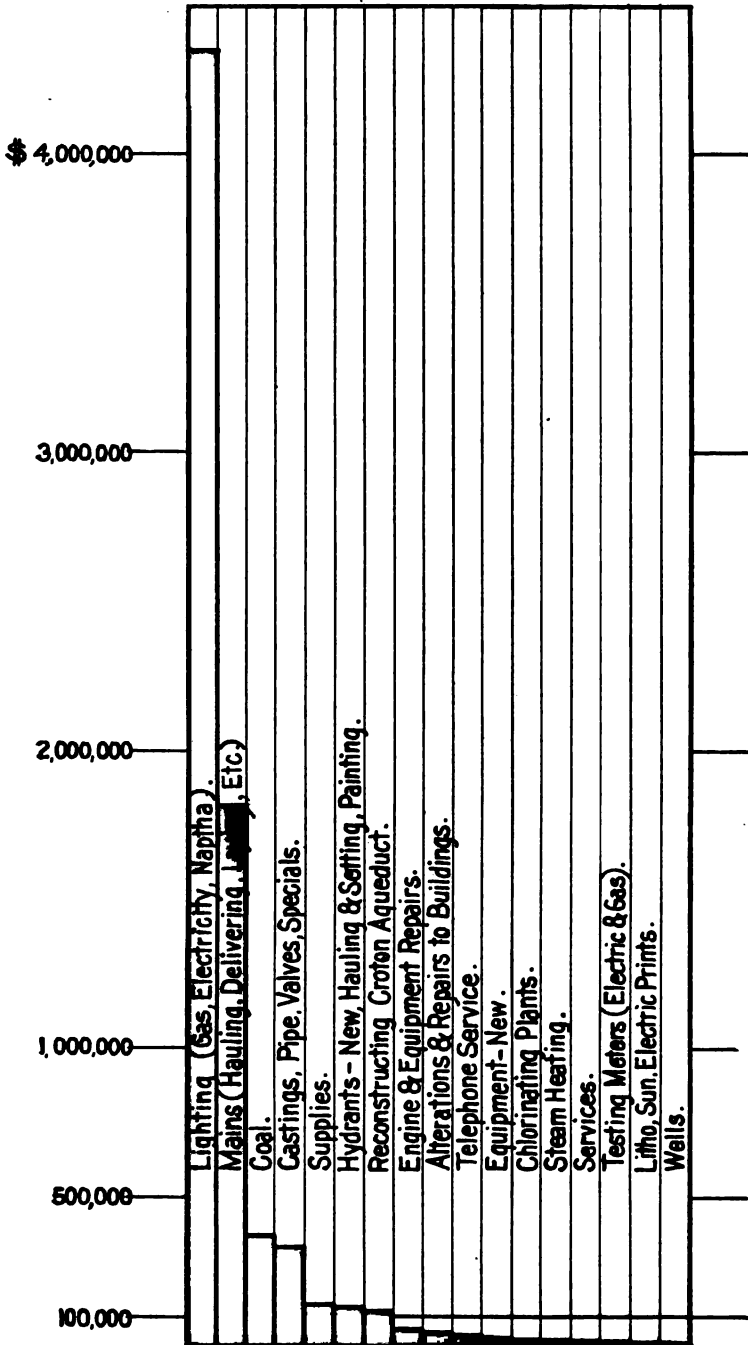
* Extract from a report to the Commissioner:

"SIR—The original requisition included a number of pieces of expensive furniture and required close scrutiny. I objected to the large sum required for new desks to be used at.....and substituted desks from the Finance Department, which cost us nothing and which were moved and put in perfect order for \$16 each. Similar furniture new would have cost about \$60 apiece."

† Men order hand-picked waste when machine-picked is in every way as suitable for the purpose for which it is to be used. (A requisition was received for some white pine for shelving, "7/8-inch by 3-inch by 16-feet long." The man drawing the requisition failed to consider that 16-foot planks are selected stock and correspondingly expensive. In this case the purchasing division altered the requisition and bought the material by the board foot, in which case it was delivered in assorted lengths of 12, 14 and 16 feet, which are every bit as good for cutting up for shelving.)

‡ The following extract is taken from a report on a requisition for furniture, drawing tables, etc.: "Another item to which I objected was a 'plan case,' to be made in accordance with elaborate specifications at a cost of \$175. A standard case made by ——— & ——— Co. (\$51.50) and serving every purpose was finally substituted by Mr. ———. (This means much quicker delivery than could be obtained were a complicated piece of furniture made to order)."

ANALYSIS OF ANNUAL CONTRACT EXPENDITURE.



Specifications.

Specifications are the description of work to be done or supplies to be furnished. They are the contractor's guide in preparing his bid or estimate and they set forth and govern the relations of the contracting parties after they have entered into their mutual agreements. The first requirements of a good specification are that it should be precise, definite and comprehensive.

Nothing should be left to the imagination in the writing of specifications. If the man desiring an article purchased or a piece of work done knows what he wants, let him describe it in straight, clean-cut, unmistakable language. This takes more time, but it is worth it. Adjectives and adverbs are particularly objectionable. To say that work must be done "properly" or "suitably" or in a "workmanlike manner" does not really mean anything because what one man will consider "proper" or "suitable" another holds to be quite the contrary. Such expressions cause great uncertainty, they develop confusion, misunderstanding, hard feelings and delay, and they contain such opportunities for unfairness and graft that they should not be tolerated. The clause that work must be done or supplies delivered "to the satisfaction of the engineer or inspector" causes every prudent contractor to bid high in self defense.

Everywhere it would appear that many men charged with the carrying out of important projects give most of their attention to matters of design and are vague or indefinite when it comes to describing the way the work is to be carried on or those relations and responsibilities between the contracting parties which so greatly affect the costs of the work. Either they do not know their own minds or if they do, they are so slipshod or neglectful that they do not give the contractor who is to bid on the work any clear idea of what is expected of him, so that he can figure closely. If honest, he protects himself with a large allowance in his bid for "contingencies," which ultimately is paid for by those for whom the work is done.

The careful scrutiny of specifications sent to the Bureau of Supplies, aided by the co-operation of many who prepare requisitions, has worked wonders in effecting improvements. A few examples of former specifications may be of interest.

The following are extracts from a report (14 September, 1911) to Commissioner Thompson on a contract for "Cutting grass, weeds, brush, etc.," criticizing the "loose" manner in which specifications were drawn.

"As an example, I refer you to paragraph 2.

"* * * 'Quality of Work: All work shall be done in a thorough 'farmer-like' manner; the cutting shall be as close to the surface of the ground as possible.'

"What is a 'farmer-like' manner? And how close to the surface of the ground is it possible to cut? The answer to these questions is like that to the old query: 'How long is a stick?'
* * * 'It all depends.'

" I maintain, Sir, that adjectives have but a small place in a specification, where precision and definiteness of ideas are most to be desired. Vague language results in certain misunderstanding and annoyance, probable delay and possible law suits.

" Another sentence reads :

" ' Sanitary precautions shall at all times be satisfactory to the Engineer, to the Department of Health of the City of New York, and to the State Board of Health ; and the contractor shall promptly and fully comply with all orders and regulations relating to this matter.'

" The contractor may well wonder by whom the orders he is to receive are to be given and what he is to do in case of a conflict of opinion on the part of the learned authorities above named."

Standardization of Specifications.

The Charter of the City of New York has a provision which states :

" No patented article shall be advertised for, contracted for, or purchased, except under such circumstances that there can be a fair and reasonable opportunity for competition."

Most purchasing agents in municipalities and in the government service are bound by similar conditions. Therefore, in mentioning the article desired, it has been customary to add the phrase, " or equal." The question now arises as to what the quality really is. Because the article delivered is different from the article called for it does not signify that it is not equal to it; "equality" does not mean "similarity"; it may be different and superior, in which case it must be accepted. It may be different and yet equal, in which case it must also be accepted; or, peradventure, it may be different and inferior, in which case it ought to be rejected.

When supplies are needed now the requisitions do not call for any particular firm's product, and add " or equal," but particular qualifications are called for instead, and bids are taken in accordance with such specifications.

The question of determining whether the quality of goods delivered is up to that called for is oftentimes more than the ordinary inspector can answer, and it sometimes puzzles even the experts. For instance, it recently became necessary to purchase certain recording pressure gauges, and the engineer requisitioning the gauges said that he wanted X's (naming a well-known maker) " or equal." Representatives of the principal firms making such articles were requested to state the chief points of a high-grade recording pressure gauge, which would determine whether the article offered was equal to what was wanted. They were practically given the opportunity of writing the specifications under which the department would purchase their product, but it was particularly pointed out to them that, as they were all reputable manufacturers handling high-grade articles, they had to

ask a fair price for them; hence if they made the specifications too easy it would permit an unscrupulous dealer to furnish an inferior article at a price below any figure which they could afford to quote.

The difficulty which these men found in describing their product was most interesting. It was finally suggested that the four points to be considered were: Materials of construction, details of construction, workmanship and accessories. In fact, almost any desired class of article can be closely described when one states what it is made of, how it is made, and the details of its construction.

It is necessary to be specific. Thus, in describing certain parts of these gauges it was specified that they must be made of "non-corrosive metal"; whereupon, I further specified the metals that would be considered non-corrosive. Some water meters were recently requested, and the officer drawing the requisition stated that "they must be accurate." "Accurate" is a comparative term, and would have led to possible bickering and controversy, so, instead, it was definitely stated what percentage of error would be allowed.

The purchasing agent who deals solely with high-grade salesmen representing established business houses with jealously regarded reputations, knows nothing of the trials and tribulations of the man who must receive tenders from anyone who chooses to put in a bid. One time when the Bureau advertised for "boxes of matches" without stating the number each box should contain, the low bidder attempted to deliver little boxes similar to the kind cigar stores pass out with every purchase of a box of cigarettes. In another instance a man delivered feather dusters which averaged about seven feathers each and gravely contended that he was within his rights as the number of feathers had not been specified.

Conferences with Manufacturers.

The ordinary salesman knows nothing of the factory conditions where his goods are produced, nor is he acquainted with the technique of production to an extent which enables him to tell how any change in specifications will affect costs. Many purchasing agents have but a clerical training, with no testing laboratory experience, and have no adequate idea of the conditions under which the goods they purchase are to be used. The salesman and the purchasing agent meet on the old ground of mutual suspicion, and discuss prices and discounts.

The most satisfactory thing to do is to get the production engineer and the factory superintendent to meet the engineer who is to use the product. The producer shows how certain customary requirements increase cost without corresponding increase in efficiency.* The man using the materials

* The Department had been in the habit of calling for "bone filtered oil" for its engines. Now, bone filtered oil looks better in the oil cups yet it costs more and gives no better lubrication. Its abandonment was suggested by an oil manufacturer.

tells of the difficulties he has encountered, and often finds he has not been calling for the proper material, nor using it correctly. Both sides profit from such meetings. The Bureau of Supplies has recently rewritten its specifications for lubricants, after such conferences, in which many of the principal oil firms in the country were represented. As an example, where before we had but one specification for cylinder oil three were prepared, one for pressures below 100 pounds without superheat, one for pressures above 100 pounds without superheat, and one for superheat conditions. Not only were the requirements of the product specified, but the manner of testing was made clear and definite.

Purchasing by Samples.

Much purchasing is done by showing a sample of what is wanted rather than by writing a specification. This method is most often used when it is desired to match a piece of furniture or a piece of hardware or for some similar purpose. Aside from these circumstances, it has no excuse except when one is purchasing articles of such trivial value that they do not warrant the cost of preparing a written description of what is wanted. Purchasing by sample is analogous to the custom of ordering a certain make of goods "or equal." The objections to this way of doing business have just been pointed out in a previous paragraph. It is generally infinitely better to state clearly what is wanted, what it is to be made of and how.

A classic example of what sometimes happens when a sample is used was unearthed during the reorganization of the purchasing division. A certain old piece of worn-out hose kept in a storeroom some distance away had for years been referred to as the sample of what should be furnished. Of course it was understood that the goods to be furnished were to be new, yet the sample was not easily accessible and when a prospective bidder did see it, he had no way of determining the number of the ply (it had couplings on each end) and neither he nor the Department could make any claim regarding that point nor the quality of the canvas, the composition of the rubber or the pressure it should stand.

Specifying Details vs. Calling for Results.

It often happens that what men desire is results and that they concern themselves but little, if at all, with the way they are produced.

Specifications based on this principle state what is wanted and leave the rest to the ingenuity of the contractor. It often happens that a clever man, left to his own devices, will develop most novel and economical ways of achieving a desired result, and will be able to underbid all competitors. However, when this way is adopted, there should be no interference with the methods employed to bring about the results. Do one of two things. Either tell the contractor what you want in the way of a result, or else

state in detail the way the work is to be done, and then abide by the consequences. Nothing is more unfair than to describe in detail the particular methods to be followed in doing a piece of work and then require a warranty as to the result.*

Purchasing Goods on Trial.

Goods could be purchased on the basis of their satisfactory performance in actual use.† The idea is that specifications are merely a device to enable the purchaser to predict the probable value of his purchase, and since what he wants is results, it would be well to take articles, put them in service and try them out. If they gave satisfaction, pay for them. If they did not, reject them and return them to the maker. In this case it would be necessary to state what performance would be regarded as meeting requirements. However, this plan is only capable of limited application. Many supplies might not be needed at once, others would require a life time to test out, and men want their money as soon after delivery of their wares as possible. The purpose of specifications is therefore not alone to set up standards regarding the kind, size and excellence of the product desired, but in the majority of cases it is to enable the department to say in advance with a fair degree of certainty whether or not goods will probably render satisfactory service, so that payments can be made promptly.

Revision of Specifications.

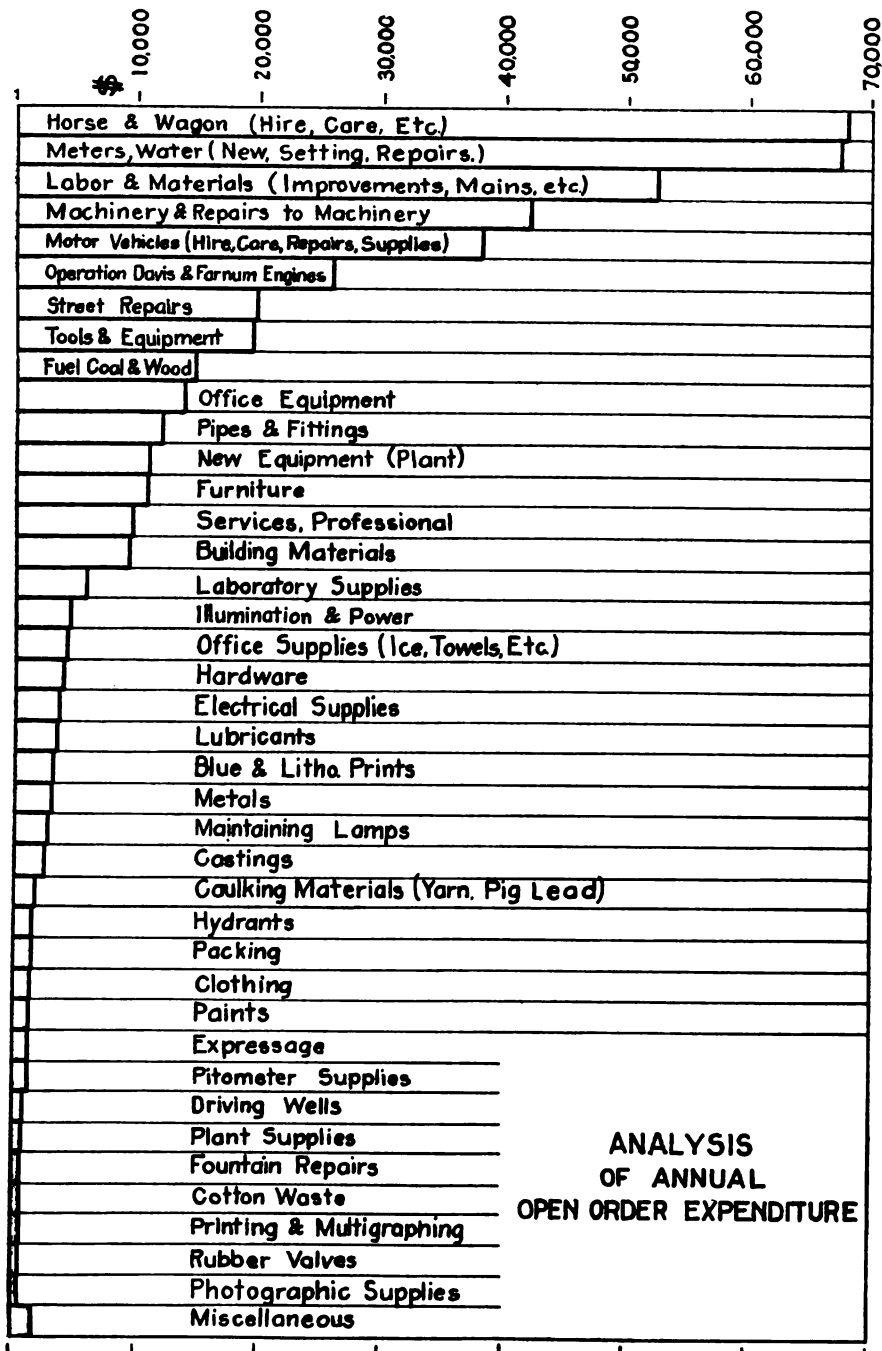
It generally happens that the men who purchase supplies do not come in contact with them when in use and have no information concerning the value and the wearing qualities of the goods they buy. The closest relations should exist between the purchasing and the operating divisions, and speci-

* The makers of steel rails have told the railroads that they will produce a rail of a given composition in a prescribed way, or they will roll a rail in accordance with their own notions of what's what, and guarantee it to render a certain service; but they will not attempt to follow the railroad's specifications and then guarantee the result.

† It has been suggested by the Bureau of Supplies that the difficulty the Department has had in getting a satisfactory specification for rubber valves for the pumps might be obviated by this method. The chemical and other laboratory tests for pump valves are difficult and often unsatisfactory in detecting substitutes. Controversies arise. Some makers claim that our specifications call for an article which is costly but not necessarily better than many others.

What is really wanted is a valve to meet certain severe service conditions. Laboratory tests are a device resorted to to indicate the probable action of the valve when used. Therefore why not do away with all laboratory tests and call on manufacturers to state a price at which they will keep certain pumps properly supplied with valves for a given period—say six months? If a maker has half the faith in his product that he claims to have, he should not object to entering into such an agreement.

A somewhat similar form of contract has been made for lubricating certain of our engines and pumps on the "output basis." The contractors (always some oil company) supply all oil necessary and are paid so much per thousand revolutions of the engines. The theory is that they will prefer to supply a small quantity of some high grade oil rather than the larger quantity that would be necessary were inferior grades furnished. It becomes to the contractor's advantage to furnish good material.



ANALYSIS
OF ANNUAL
OPEN ORDER EXPENDITURE

cations should be continually amended to include improvements and to exclude materials which do not give satisfaction.

Many valuable suggestions would be furnished by a Board of Survey (see page 13) passing on all old equipment and deciding whether damaged material is worth repairing or should be scrapped, and whether material alleged to be inefficient should be discarded. The Board would thus obtain information concerning the way different supplies and materials act when in service and what ultimately renders them unfit for further use. Such notes would be of great assistance to the purchasing division.

CORRECT QUANTITY.

The problem of purchasing the right quantity of supplies at a time is complex and depends for its solution on data all of which the Bureau of Supplies has so far been unable to gather. The principles governing the matter are here formulated that there may be a clear idea of the information required, and the ways to go about getting and using it.

1st. There must be records showing the total quantity and nature of all stock on hand.

It was found that many requisitions for supplies were based on the orders of previous years, irrespective of whether such material had been used, and without considering that conditions and requirements often changed in the meanwhile.

Inventory.

"A complete inventory of the property of the department under the jurisdiction of the Bureau of Supplies has been undertaken and completed. It is incomprehensible that the matter was never attended to before. As a result of this inventory, complete control of stores may be obtained in the near future.

"A record of the goods stored in each of the central storerooms is kept on a card system at that point. This is changed from day to day as goods are received or issued, so it is always up to date. A similar record, using ledgers, is kept in the central, or stores control office. It, too, is always kept posted by means of the reports of "stores received" and "stores issued" sent in from the various storerooms at the close of each day's work. I regard the successful working out of this control as one of the most important achievements of my administration of the Bureau of Supplies, for, as I pointed out in my last annual report: "When this is completed, it will prevent the purchase of material of which we already have sufficient in stock, and it will facilitate the transfer of surplus material from one borough to another to meet any sudden emergency or other demand."*

* Extract from the 1912 Annual Report to the Commissioner by the Author.

2nd. A material budget should be prepared containing the annual amount of all staple supplies used by the department. This data should be ultimately extended to give the average monthly consumption of each item.

The Bureau of Supplies might collect such information from the records of material issued from stores and material purchased for direct delivery to consumer. This would be a left handed way of proceeding, however, for many issues are not used immediately but are held in local storerooms (beyond the present jurisdiction of the Bureau of Supplies) for subsequent use. The proper study of the question should begin with an investigation conducted by "staff" experts of all points under the department where supplies are used,* for the purpose of determining the nature of the work done and whether or not the supplies consumed are excessive, normal, or economical, compared to the results obtained. Incidentally, this would be a most interesting feature of an "efficiency survey" of the activities of the whole department.

By adding together the amounts of material thus found to be necessary, one would arrive at a very good budget for material needed for current operation.

3rd. The amount of material needed to meet the plans for new work, repairs, renewals, and so forth (wherever the same are to be purchased by the Department) should be carefully calculated when the said undertakings are decided upon, and the Supply Bureau immediately informed.

As practically all work of this nature is presumed to be done in accordance with a definite program, the information bearing on the supplies can be furnished months in advance of the day they are needed.

Knowing approximately the total amounts of the various supplies needed, the amount of them to get at any one time can be determined by considering each item separately.

While there are many advantages in purchasing in wholesale quantities, there are, on the other hand, certain disadvantages which should be taken into account.

Reasons for Purchasing Large Quantities at One Time Are:

1. To take advantage of wholesale rates.
2. To have orders sufficiently large to tempt manufacturers to bid direct and thus cut out middlemen's profits.
3. To profit by the proportionate lower cost of delivering large quantities of goods at one time.

* This investigation should be made in connection with the work of establishing standards of equipment and grades of material as recommended on page 34 of this report.

4. To secure sufficient stock at times when prices are low to last over until low prices again occur.
5. To reduce the cost of the purchasing division by having a few large orders to attend to rather than a lot of small ones.
6. To reduce the cost of inspections by decreasing their number.

Disadvantages of Buying a Large Quantity of Any Material at One Time.

1. Room is required to store goods; space is valuable.
2. Supervision required over goods in storage which costs money.
3. Interest on money tied up in unproductive materials.
4. Insurance and taxes.
5. Deterioration of stock.

The results should not be guessed at; they should be carefully figured out.

LOW PRICE.

Every endeavor has been made to make all purchases at the lowest price possible. The subject of price has been investigated from the standpoint of the bidder (the man who quotes the price), and obstructions have been removed and conditions arranged so that business may be transacted with the utmost economy.

Quarterly Contracts.

An endeavor has been made to eliminate the "middleman" wherever possible and to deal direct with the maker of the goods. In order to interest manufacturers and get them to bid, it is necessary to purchase fairly large quantities at a time. Previous to the present administration of the Bureau of Supplies, goods were purchased immediately upon receipt of the requisitions requesting them, and irrespective of the smallness of the quantity called for. This meant purchasing from supply houses in small quantities at irregular intervals and at high retail prices. To remedy this, the principle was adopted of purchasing supplies on quarterly contract—requisitions for supplies needed for a considerable period of time being sent in in advance.

This greatly increased the quantity of the various materials to be obtained at one time. Furthermore, requisitions by different men for similar supplies were then combined in an endeavor to tempt manufacturers to bid direct. It is very advantageous to do business after this fashion with the makers of goods. It reduces delay, it lessens possible misunderstanding, it centers responsibility, it saves middlemen's profits and results in low unit cost of delivery.

Combination of Requisitions.

The attempted combination of all requisitions for materials to be used for like purpose at various points throughout the department, in order to

purchase the whole amount at one time at wholesale prices, first showed the imperative necessity for standardizing the current supplies. Not only is there great difference in the nature and quality of supplies ordered by different men for identical purposes, but it often takes careful scrutiny to recognize the relationship between various requisitions for the same material. For instance, one man will order rope, specifying its diameter; another man wants rope of a certain circumference, a third wants rope which will weigh so much per lineal foot. Yet, as a matter of fact, they all want the same size rope, and have only described it in different ways.

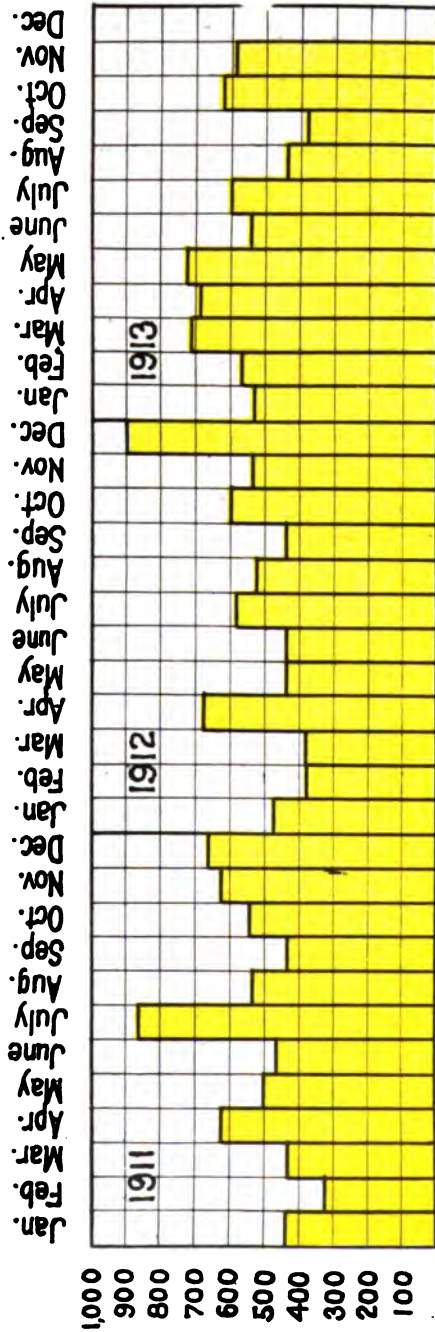
Moreover to carry out this policy of letting contracts quarterly orders were issued throughout the department during the fall of 1911 that requisitions be immediately prepared for such supplies as would be needed during a three months' period, and then sent to the Bureau of Supplies, that the same might be contracted for as soon after January 1 next as possible. Delay followed delay. Lacking a material budget, many officials were unable to make out requisitions which were either accurate or adequate. Many requisitions described what was wanted so meagerly or unsatisfactorily that they had to be sent back for correction. The idea of quarterly contracts was good but the foundation work necessary to make it a success in the Department of Water Supply, Gas and Electricity had not been laid at that time. The work of standardizing supplies, determining stock limits, and preparing a material budget which is now being undertaken by the Bureau of Supplies must first be completed. These things must be attended to as soon as possible, for the near future will demand the adoption of all sound and economical methods in the public business.

Bidding for Different Classifications Separately.

Due consideration is now given to the fact that manufacturers and large dealers handle goods of but a single kind. Therefore, it is necessary, in order to get them to bid, to get bids separately on goods handled by the different trades.

This applies not alone to the large quarterly contracts, but is given due consideration in those small (open market) orders which the city permits for expenditures up to \$1,000, and which are made necessary by various emergencies that may arise from time to time. A recent requisition for a particular job was received which called for approximately \$500 worth of valves and pipe fittings, a box of candles and 10 pounds of white lead. Had bids been requested on these items combined, responses would only have been received from the various supply houses, whereas, the order for pipes and fittings was sufficiently large to attract the principal dealers. Candles, which are plumbers' supplies, and white lead, which is regarded as a painter's supply, would have prevented them from bidding.

NUMBER OF OPEN MARKET ORDERS ISSUED MONTH BY MONTH.



OPEN MARKET ORDERS ARE ISSUED FOR

WORK DONE—GOODS DELIVERED.

"Confirming Verbal Order." This is generally the result of some emergency.

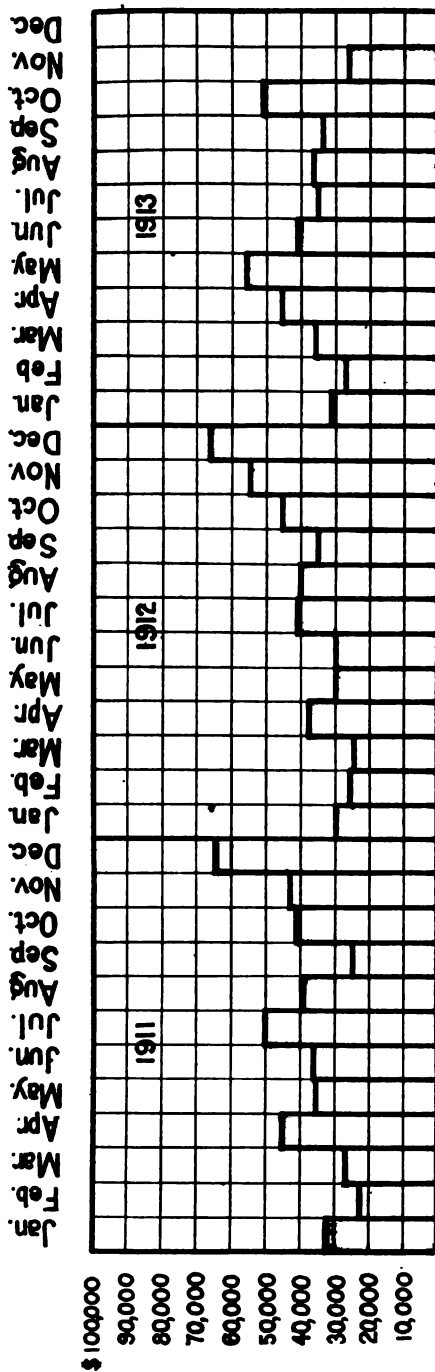
WORK DONE—GOODS DELIVERED.

"Monthly or Quarterly Orders" placed with parties considered best fitted to render the service. They include Horse and Wagon hire, meter setting, etc.

WORK DONE—GOODS DELIVERED.

Bids are taken for this work. It involves all matters considered too small to warrant the cost of letting by contract—or which are of such urgency that the contract procedure would take too much time.

AMOUNT OF MONEY SPENT ON OPEN MARKET ORDERS MONTH BY MONTH.



The rise during January, April, July and October is due to the placing of Quarterly Requisitions at such periods. The chart also shows the effect of the segregated budget combined with the policy of permitting transfers of funds. Most of these transfers are allowed in the Fall, which makes that a period of heavy spending.

Relative Advantages and Disadvantages of Purchasing Supplies by "Totals" and by "Items."

The principles governing the question of purchasing supplies are unlike those concerning the letting of contracts for work to be done, since "unbalanced bidding" can not exist where the quantity of material bought is the same as that bid on.

As stated before, supply contracts should be so drawn that goods in different groups or divisions, as determined by manufacturing specialization or trade usage, may be bid on separately; for if orders are drawn to contain goods of different classifications the bidders will be "middlemen" and "commission merchants," not the makers of the wares nor the regular dealers in the various subdivisions in which supplies are customarily bought and sold.

These "middlemen" besides adding their profits to the manufacturer's price, thus increasing the cost of the article, are, as a rule, irresponsible parties with whom it is most unsatisfactory to do business.

Having settled the point that goods should be contracted for by their respective classifications, the question arises: Is it more advantageous to the department for it to purchase supplies of a given character by "totals" or by "items." The matter must be regarded from various aspects.

As regards price two cases may arise:

First—Where a dealer knows that the entire order will be given to the man making the lowest "total" bid he quotes a wholesale price on the whole order.

Second—On the contrary, if the order is to be let by "items," any one dealer may obtain but a single item. Facing this possibility, no sane man makes his bid on each individual item a pro rata of his estimate of the wholesale price at which he could supply the entire quantity of goods. Instead, he bids a retail price on each item because he cannot safely do otherwise. The result is that the cost to the Department is the sum of the lowest *retail* prices bid on the various items.

I have devised the following method as best solving the difficulty:

Require the bids to be both by "items" and by "totals"—in which case the bidder indicates what he will supply anyone of the items for separately—and also the wholesale price at which he will furnish them all.

Then if any of the total bids are less than the sum of the lowest individual bids on all the items (as they probably will be), the contract will be awarded to the maker of said lowest total bid—otherwise the orders will be given to the lowest individual bidders on each of the separate items.

The advantages of purchasing supplies by "totals," under the various classifications are:

1. The responsibility concerning the quality of the work and the time of completion is centered and easily placed.

2. The work of the Bureau of Supplies, of the Bureau of Audit and Accounts, and of the departmental inspectors is simplified as they only have one party to deal with.

The advantages of purchasing supplies by items are:

1. It is sometimes advisable to purchase in small quantities in order to satisfy local supply houses who are incapable of handling the whole order, but are desirous of having a chance at part of it.

2. With only one or two large dealers in the field it is occasionally well to award orders by items in order to develop the small dealer and promote a healthy competition.

If the awards are made by items, the best firms, wholesalers and manufacturers frequently will not bid, as the orders are too small, making the cost of handling such orders more than the profit, as may be seen by the following figures:

Orders for tools issued recently on a public letting: 92 orders issued, total, \$706.06, average per order, \$7.63. Number of orders for amounts less than \$5.00—65. Number of orders for amounts less than \$1.00—23.

It is impossible for bidders when making their bids to estimate properly the delivery charges, because they do not now know in advance whether a delivery will amount to \$1 or \$100, or whether the material to be delivered will be a small package or a truck-load or a car-load.

Furthermore, the cost and trouble which firms are at present put to in preparing certified checks is more than business under this condition is worth.

If the successful bidders are to be those quoting the lowest price for individual items, many firms would prefer not to do business with the City, because the City is considered by them a consumer, and they fear making their very best prices to a consumer, as it would expose their methods of doing business to their competitors. Suppose a firm should be in a position to make a particularly good price on an article, because they could purchase the merchandise very cheaply, or because they have the merchandise on hand, they would not give the City the benefit of this low price unless the furnishing of this article would carry with it other business.

At present the largest and best firms are not particularly anxious for City business, even in large orders, because of the old reputation for delay in getting payments, the difficulty, nay impossibility of making adjustments in price to cover slight irregularities in quantity or quality, the possibility of rejection by the Finance Department necessitating replacement and redelivery; all of which go to make the handling of this business both expensive and uncertain. Furthermore, the security checks deposited by low bidders are retained till delivery is completed, and if an order given is very small, as frequently occurs when awarding by item, the security check may be larger than the order received. This produces an unbusinesslike condition,

as it necessitates the use of more money for a period of possibly ninety days than the actual gross amount of the business obtained.

It is impossible to estimate the cost to the City of awarding the small orders by items, as it greatly increases the number of orders; and when the number of hands through which these orders, accompanying vouchers and checks, pass in this and the Finance Department is considered, the increased work can hardly be imagined.

The delay in the splitting up of the business by items is also a material factor.* This delay, of course, is due to the great amount of labor necessary for canvassing the bids, settling the tie bids, and the general work necessary in the case. This delay not only seriously affects and retards the work of the Department, but also makes it very difficult for the successful bidders to accept such orders, because of the possible changes in price and other conditions which may take place in the interval between submitting a bid and receiving an award. Every endeavor is now being made to reduce this to as short a time as possible and great progress has been made.

The following will illustrate the attitude of bidders toward the matter. In a certain bid for drafting material which was opened in this office, there were five bidders tied for five items. When the representatives of these firms met in this office to settle as to who should receive these awards, they unanimously decided to draw lots, the lucky man to get all the items on which they were tied. This proved, as they all stated on this occasion, that they did not care much about items individually but preferred to have all or nothing.

Large Competition.

It is recognized that one of the elements most likely to secure low prices is an active competition between rival dealers. To secure this, the names of possible bidders are listed under the heading of the particular class of goods in which they specialize. Before making purchases, all parties making the goods in question are notified of the fact by letter and they are invited to bid. This policy of publicity has been very successful and has been much appreciated by all who do business with the department. It has resulted in interesting and securing bids from many who have not previously made any attempt to secure City work, and it shows to all men that the contracts of the department are awarded without favor and to any party qualified to do the work or supply the materials called for.

Purchasing Standard Materials.

The saving in price due to the purchase of standard materials has already been referred to under the heading of standardizing specifications. While the exact amount of this saving cannot always be calculated, it is known to be very great.

* The orders on the public letting bids which were opened on June 2d, 5th and 7th, 1912, were issued on July 18th, 19th and 20th, or a month and a half after the bids were received.

How Definite Requirements Affect Prices.*

It is a noticeable fact that where the specifications are indefinite, the difference between the lowest and the highest bids is very great, but where the requirements to be met are clear and precise, all the prices are about the same.

Reducing Delivery Charges.

Since the cost of delivering supplies is included in the bid, the department immediately profits by any steps which can be taken to reduce this item.

The two main savings have been affected by:

1. Purchasing large quantities at one time.
2. Reducing the number of delivery points.

1. Up to a certain point, the larger the quantity delivered the less the unit charge for crating, shipping, billing, etc., becomes. It frequently costs a manufacturer about as much to deliver a small order as it does to deliver a large one—while the office expense is about the same in either case.*

2. A great saving has been effected by having supplies delivered in quantity at some central storehouse. Subsequent delivery of small quantities to widely scattered and often inaccessible points being made by the department itself with auto truck. Where this is done, the bid price, chargeable to delivery, becomes very small.

Promptness in Awarding Contracts.

All bids are publicly opened and read. However, where the letting is large and involves a great number of items, it often takes quite a bit of time to tabulate all the prices. The work is expedited so that the low bidders may be notified and awards made as soon as possible, for delay in this respect might cause loss and inconvenience to bidders due to changes in prices and market conditions in the interval.

Prompt Payment of Bills.

Delay in paying bills does more to discredit a department with contractors, to discourage many of the best firms from competing for city business and to cause those who do bid to bid high in self defense, than almost any of the other iniquities of lax and inefficient administration.

On the other hand, a reputation for fairness and promptness in meeting all obligations can only result from a carefully thought out business pro-

* It has been a habit when purchasing oil, etc., to state that "deliveries to be made as needed." This affects prices as it costs more to be continually delivering small lots than it does to make one delivery of the entire quantity. Furthermore, this requirement is so indefinite that no contractor could estimate his delivery charges with any degree of accuracy. Under it he might be called on to deliver a barrel at a time. Again, each delivery means a separate inspection and analysis cost the Department about \$10 each.

cedure where system rules and all work goes forward systematically without halts and delays.

Prompt payment of bills requires prompt inspections and a method of despatching which will convey these reports to the auditor in the shortest possible time so that he may pass the bills and forward them to the Comptroller for payment.

The remarkable results achieved by the present administration are outlined in the chapter on Inspecting.

Square Deal, No "Hold-Up."

Another consideration which has been persistently worked for, is to systematize all procedure so that honesty and fair dealing do not depend on the personalities of the men now in office or of those likely to come into office at some future time, but that the laws laid down for carrying on the work are such that there can be no opportunity for unfairness or discrimination toward any one doing business with the Bureau of Supplies. All of the chapters of this report contain detailed descriptions of what has been done in this respect.

Witness the purchase of goods under such definite requirements, that no matter who gets the order he will have to do the work properly: the elimination of adjectives and adverbs, and such clauses as "work-to-be-done-in-a-suitable manner," or "to-the-satisfaction-of-somebody-or-other," from specifications; the publicity given to all lettings, and the notices thereof sent broadcast to all possible bidders; the immediate inspection of goods upon their delivery, the right appeal on any rejection, the privilege of a re-inspection by a different inspector when goods have been rejected; the opportunity of being present when one's own goods, or the goods of any competitor are being inspected, or analyzed and tested in the laboratory.

The "pigeon-hole" is the lair of graft. Any business which does not keep all matters constantly on the move, and does not have adequate records to show the progress thereof and to indicate if affairs are sidetracked, and if so by whom, is wrong in principle and in practice.

When a man can "pigeon-hole" papers and then wait until the people interested come along and get him to take them out again, that man—well, if he isn't built of the right stuff, he may be subjected to temptation.

Cost Data.

A knowledge of costs and values of materials is of vital importance to the Chief of a Bureau who employs scientific methods to obtain low prices.

A start at the collection, tabulation, and study of such data has been undertaken by the present administration of the Bureau.

It has been noticed that many of the present methods of purchasing are fundamentally wrong, inasmuch as they call for prices for supplies where the price bid must include several different and unrelated factors.

For example: In purchasing hydrants the Engineering Bureau has been in the habit of estimating the number that would be required at the various points during some long period and then bids were requested on this basis—delivery to be made from time to time. Sometimes these estimates of the relative number of hydrants required at the various points are incorrect and it then becomes necessary to take hydrants immediately upon their delivery at some yard and cart them to some other yard far distant. This is expensive.

When hydrants are contracted for, delivery to be made at different yards during a stated period, the bids should state a price for the hydrants F. O. B. at the foundry and then separate delivery charges to the different yards of the Department. For the purpose of comparing and canvassing bids, the relative number to be delivered at each point will be assumed. This is subject to change, however. Contractors will be directed to deliver their goods at the yard where they are needed, and actual payment therefor will be on the basis of the F. O. B. cost of the article plus the bid price for delivery to the point in question.

It can be easily seen that under the old conditions no definite analysis of costs could be made, for it was impossible to tell what proportion of the total price bid was for the hydrants and what was for the delivery. When the price of goods and the costs of delivery are stated separately as suggested, one can chart all seasonal and annual changes in the actual cost of goods, and one can further grasp the expense to the department where conditions made deliveries expensive. It is on such data that improvements can be made.

Undesirable Bidders Should Be Eliminated.

Since all purchases are advertised in advance and anyone not in actual default on a previous contract is permitted by law to put in a bid, it frequently happens that the low bidder is some irresponsible party, of a type or reputation such that the purchasing agent of a railroad or other large corporation would absolutely refuse to do business with him. They are the kind of men who "do business on a shoe string," who have their "office in their hat," or at best rent desk room somewhere, and whose name does not appear in the telephone book. They often stand equally willing to bid on supplies, to write you a life insurance policy, to rent you a piece of property or to sell you a book.

When an order is awarded them, they go out and peddle it around in the hopes of getting someone else to furnish the supplies or do the work at their figure and give them a small commission for their pains.

Another equally undesirable variety is the irresponsible individuals or firms who bid low apparently hoping to get the order and then unload a poor grade of goods on the city. The goods are inspected and rejected, considerable time elapses, the rejected material is replaced, the replacement

is inspected and in turn rejected, and so it continues while the men needing the material have to wait and wait and w-a-i-t, and the interests of the city suffer in consequence.*

To eliminate this undesirable element, all bidders should be required to present such satisfactory evidence of their financial standing, experience, shop facilities or business connections that it is evident that they are qualified to receive the order and execute it according to its terms within the allowable time limit.

Routine, Supplies and Equipment.†

There are certain classes of supplies, of which it is necessary to purchase large quantities year after year. Under these circumstances there is a tendency to adopt a departmental design. For instance, a city determines to have its own special hydrant. Drawings are made, detailed specifications are prepared, and manufacturers requested to bid in accordance therewith. What is the result? Whereas before many independent manufacturers had bid, they now hold off, for the cost of a new pattern in accordance with the special City design must be reckoned; also, it is a bothersome matter. The firm getting the first contract has a substantial advantage in subsequent contracts, for, having the patterns on special machinery needed, they can underbid all other competitors. The City pays the difference. For this it has the advantage of the fewer spare parts needed to be kept on hand, but loses such advantage as may be obtained by getting the latest commercial article with its up-to-date improvements. Special departmental designs tend to become obsolete, and, unless the City owns its patterns and furnishes them gratis to the successful bidder, such special designs are expensive luxuries. In fact, it is a wise maxim to "let the seller design the goods."

The purchase of equipment or new machinery introduces additional problems. There is a tendency at the present time to purchase machinery for which there is no justification on the score of economy or efficiency. An automatic ash-handling device, a patented stoker, or other labor-saving machine may be economical, but because it is economical in one situation does not mean that its purchase is warranted under all conditions. The purchase of equipment, whether in a municipality or in the government service, should receive the same careful attention and care as is accorded by a private enterprise. Whereas the City's equipment is purchased out of corporate stock, revenue, or tax levy, the economic consideration of the problem should be that taken by the private corporations, where, to obtain money, bonds must be sold and interest paid thereon.

* The City has the right where rejected material is not replaced within the five days allowed, to purchase what was specified in the open market and charge the cost thereof against the delinquent contractor. Often this is not a feasible remedy, because the goods must be specially made, a process requiring considerable time.

† This paragraph is an extract from a paper by the author, which was read at the first meeting of the Efficiency Society, held in New York City March 18 and 19, 1912.

The depreciation of the equipment must also be estimated, and the probable cost of repairs carefully ascertained. The cost of operation must also be included in the calculation. The automatic ash-handling machine dispenses with the services of several laborers, but requires the attention of a machinist. The device also requires power for its operation. If electric current is used, it must be paid for; if steam from one's own boilers is used, coal must be bought and burned to generate it. Furthermore, the fire insurance rate on the new equipment should also be given consideration.

If the estimated saving simply equals the interest on the investment, plus depreciation, plus repairs, plus cost of operation, plus fire insurance, we have an "even break," and the purchase is not justified. The difficulty in estimating these various costs makes it advisable never to purchase any new equipment unless the probable saving, plus 20 per cent. per annum on the original cost, is equal to or greater than the above-mentioned items. This is not properly a matter which comes within the duties of the purchasing department, but should be investigated by the staff division of the Engineering Bureau before making any requisition.

CHAPTER IV.

INSPECTION OF SUPPLIES

Purpose—Methods followed—Reports. The inspection of workmanship and material embraced in construction contracts is attended to by the particular bureau for whom such work is being done.

The purpose of inspection is to make sure that the quantity and quality of goods delivered correspond with what was called for.

In the days before there was a storekeeping system and when practically all supplies were delivered direct to the men who were going to use them, these men themselves, in many instances, made whatever inspection was attempted. Strange to say, it was hard to overcome this way of doing things, for some argued that no one knew better what he wanted than the man who ordered the goods, therefore no one was better fitted to inspect them. Needless to say, "what the man wanted" is not the criterion to use in passing on supplies. Men often have very vague ideas concerning what they want, and many requests for material are indefinite, while others are actually self contradictory. The point to be settled is whether or not the Department is getting exactly what was described by the specifications.

When the work of inspection was done by many men, different ideas existed regarding the interpretation of specifications, and goods that one man would accept, another would reject. In order that the same standards might prevail everywhere throughout the Department, the only employees* now allowed to pass on goods are the trained storekeepers who inspect all supplies delivered at storerooms, and the inspectors who travel around and check up the direct deliveries.

The standardization of specifications has made all this work much simpler and easier. Take for example the perplexing problem that in times past confronted an inspector when looking over a complicated piece of mechanism at some out-of-the-way pumping station, and reference to the order under which it was purchased informed him that it was to be X's or "equal thereto." It has been pointed out under the head of "Specification," that making a decision regarding such a matter is most difficult,

* Certain supplies, such as pipe, special castings, etc., are often inspected at the point of manufacture by representatives of the Bureau which will use the goods.

especially when the goods offered are at all similar in grade to those mentioned as a standard. Seldom was there any sample of the "standard" available with which to make comparisons, and even if there were, how was an inspector, not himself a technical man, to weigh the relative points of excellence of one or the other? Such determinations might well puzzle experts in the particular line involved, for it must be clearly kept in mind that "equality" does not imply "similarity."

There is a rule in the City service to the effect no agreement can be entered into whereby goods not up to specifications can be accepted and a suitable reduction made in the price. The goods delivered must be exactly those called for. It often happens that goods are not either in whole or in part, precisely in accordance with the specifications, though for all practical purposes, equally suitable for the use to which they are to be put. When this happens in commercial practice, an agreement would be quickly arrived at between the buyer and the seller, the shipment would be accepted and a proper deduction made in the bill. The City cannot do this.

On the other hand, where there is some slight shortage in quantity, the goods are accepted and a pro rata reduction made in the payment.

Long and uncertain periods used to elapse between the delivery of goods and a report of their inspection reaching the auditor. Since no goods can be paid for till they have been accepted; and quick payment of bills is one of the ideals now being striven for, every effort is made to expedite the work of inspection in order to attract bidders and stimulate competition.

A procedure has been developed for doing this work systematically and with the least likelihood of error or delay.

Storekeepers place all incoming goods in an "inspection cage" where they remain till unpacked and checked for size, quantity and quality. If the determination of quality requires an analysis, a sample is sent to the laboratory. Satisfactory material is at once put into stock and rejected material is packed up for return shipment and put in a separate room by itself—and a report sent to the central office. All this is generally done the same day the goods are received.

The new policy of having practically all goods delivered at store houses has simplified and expedited the inspection problem to a remarkable degree. However, there are times when it is best to deliver supplies direct to the point where they are to be used (lumber, cement, etc.): This is particularly true at present as the new delivery system has not yet been put in operation. All such delivery points are supplied with addressed postals on which the men receiving goods are directed to immediately notify the central office of their arrival.

These cards are sorted by a clerk who checks off the deliveries on the Record of Purchases. The cards are then turned over to the inspectors to show them what points to go to. Formerly there was no system in making inspections, inspectors going hither and thither, in a most obliging but inefficient way. Now certain territories are covered on certain specified days.

For instance, all points in the Croton Watershed reporting stores received are visited on Mondays, Manhattan Borough points on Tuesdays, Brooklyn on Wednesdays, and so forth. This program is adhered to as closely as circumstances will permit. As the cycle is completed within the week, the maximum time that can elapse between the arrival and the inspection of any duly reported direct delivery is seven days, while the average interval is but three and a half.

Quite a change from the days when dealers stormed into the office to know why goods delivered weeks before had not been paid for, and had to be told it was because no one had been around to inspect them! The average time which it used to take to make a report on material is estimated to have been a matter of weeks. It is now but a few days on all shipments not requiring a laboratory analysis. No wonder in the old days engineers who had permitted themselves to get short of stock used materials before they were tested, and suspicious contractors hinted at favoritism.

The old and the new channels taken in reporting inspections are as shown on opposite page.

Reports on Inspections.

The result of the inspection is noted on the Record of Purchases, and the Bureau for whom the goods were purchased notified of the result.

If the goods are satisfactory the bills are certified and forwarded to the Auditor. If the goods do not meet the specifications a letter is written to the contractor stating in detail where the requirements had not been complied with, and he is directed to remove the rejected material and replace with proper goods. The articles to be replaced are entered on a Record of Replacement and treated as though they were new orders.

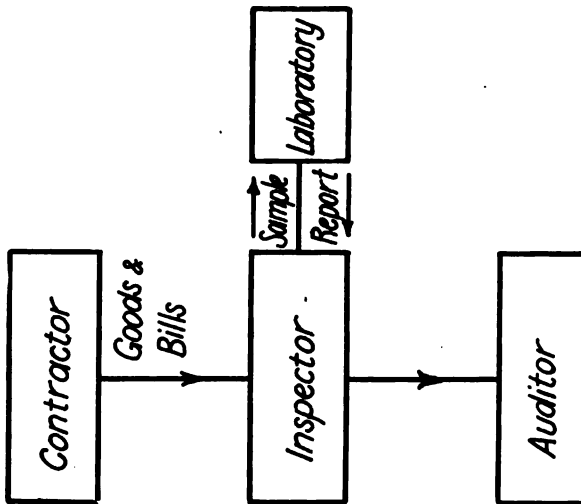
When rejections are objected to, the contractor is given a hearing, a re-inspection (by another inspector) is accorded him if requested, and no pains are spared to show him that the goods failed to pass on their merits.

Charge for Re-inspections.

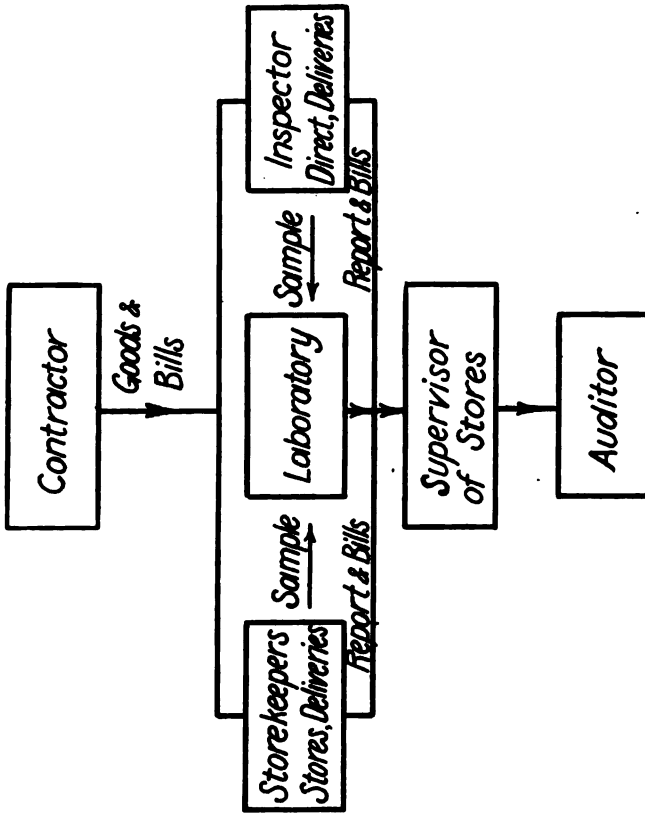
The Department has been put to expense by reason of making re-inspections of rejected materials and inspections of goods replacing those previously rejected. To cut this down as far as possible, a clause is inserted in all specifications to the effect that a charge of ten dollars will be deducted from the bill for any re-analysis of a rejected material (except in the rare instance that the previous analysis was wrong) and for each and every analysis required to be made of "replacements."

It is hoped thereby to discourage the habit in dealers of challenging every rejection "on general principles" and that other most reprehensible custom of first delivering poor goods or a poor sample in the apparent hopes that it will "slip through."

OLD PROCEDURE.



NEW PROCEDURE.



CHAPTER V.

STORAGE AND ISSUE

Fixing Stock Limits—Care of Supplies—Equipment of Store-rooms—Rules for Storekeepers—Issues—Loans and Transfers of Supplies—Subsidiary Stores.

Why have any storerooms at all? That appears to be a rather radical question, yet it is a perfectly fair one to ask. This Department got along without them for years. Many other large corporations do likewise. It is admitted that many a storeroom is of little value, some even constituting a very positive drain upon the resources of the organizations which maintain them. Therefore, why have storerooms? Why not have the dealers who furnish supplies deliver them all direct to the consumers as required?

In order to answer these questions and determine what type of storeroom, if any, best suits a given condition, it will be necessary to analyze the storage problem and fix its advantages and its limitations.

Since the price of many articles fluctuates greatly during the course of a year, it should be a purchasing policy to "stock up" at the time when goods may be bought most cheaply. A storeroom in which such supplies are kept till wanted may be likened to a "storage reservoir" in a watershed where the abundance of the spring rains are collected and held till the period of summer drought.

Furthermore, up to a certain point, lower prices are obtained by the purchase of large quantities at one time; but the limit of wholesale buying is fixed by the fact that keeping stock involves loss through:

- Interest on money tied up in unproductive materials.
- Insurance and taxes.
- Deterioration.
- Cost of excess storage space.
- Cost of Supervision.

These conditions therefore determine the maximum quantities of current supplies which can be profitably stored.

On the other hand it takes time to obtain or replenish stock by purchase, so sufficient supplies for current consumption must be carried in order to tide over the interval required to get more.

Again, it is much cheaper for a dealer or manufacturer to ship a large consignment to a single conveniently located storeroom (for subsequent local distribution by the department) than it would be to box and deliver the same supplies in various small quantities at numerous different points. All delivery charges are included in the bid prices and are thus ultimately, though indirectly, paid by the City.

A central storeroom serving a large number of consumers acts as an "equalizing reservoir." Its stock is available to meet their varying requirements, and this makes it unnecessary to keep large quantities of material at local points, for it is much easier to estimate the collective needs of a large number of isolated stations than it is to determine their individual requirements.

Similarly, emergency equipment held in reserve at a central point is more available than it would be if divided up pro rata among many local stations.

The most economical system is the one which renders prompt and adequate service with the minimum amount of money tied up in stock.

Not only do economical purchasing methods, low delivery charges, prompt inspections, the maintenance of adequate emergency reserves, and the ability to most efficiently supply the current demands of many different consumers, all require the accumulation and storage of stock at central points, but, furthermore, experience has shown that such materials should be exclusively under the control of the Bureau of Supplies. It is now conceded to be a grave error in organization to place the control of materials and supplies in the hands of the men who are to use them. The storage and issue of supplies have therefore been put upon an entirely new basis during the past two years.

The policy has now been adopted of concentrating the storage of the supplies of the department in especially equipped storerooms and then placing the care and operation of the same in the hands of trained men. These storekeepers receive, inspect, store and issue supplies; they keep accurate records concerning the goods entrusted to them; and they report directly to the Chief of the Bureau of Supplies. It is at last recognized as inconsistent to keep accounts of money with great accuracy and then when the money is invested in stores to pay no attention whether they are used or wasted.

With one man from the Bureau of Supplies in charge of these storage points responsibility is finally definitely located. Even if this arrangement had increased the number of men required to handle stores—which, by the way, does not appear to have been the case—the economy in consumption

and the diminution of waste which the direct control has effected, has far more than offset any such increases.*

Differences, due to the strict enforcement of the rules regulating the distribution of supplies, are always to be anticipated when an orderly system takes the place of old and slipshod (less efficient) methods. In this case they were easily adjusted as they arose.

The two main accomplishments of the Bureau of Supplies in the field of Storage and Issue have been in proper "storekeeping" and effective "accounting-control." The fundamental principles thereof have been formulated and the details by which these principles could best be adapted to the peculiar conditions of the department have been studied and standard practice instructions prepared to carry them into effect.

Storekeepers.

Having decided that the men in control of supplies should not be those who were to use them, it became necessary to organize a staff of storekeepers. An endeavor was made to obtain men with special aptitude for this work. As the men were appointed they were assigned to the 179th Street Storeroom. This was the first central storeroom to be put in operation and it was utilized as a training school for all the new men. When they

* As additional points were turned over to the Bureau of Supplies, the previous conditions continued to reveal themselves. Disorder and confusion were everywhere.

Most of the buildings used for the storage and handling of supplies were in bad repair and unsuited to the purpose.

Stores were kept in a large number of different places and were not conveniently located.

Responsibility for the care of supplies was not centered on any individual. There were no inventories. In many instances men were permitted to remove supplies without making any record of what they had taken.

No proper bins or shelves were provided for many classes of stores and supplies.

Stock was seldom separated into those articles frequently called for, and those seldom required.

Stores which had been received and had not yet been inspected were placed in the same room with goods which had already passed inspection.

Notices of rejection were not sent out systematically.

Goods which had been inspected and rejected were not marked in any distinctive manner to indicate the fact nor were they separated from regular stock.

Supplies were poorly taken care of in many instances.

Much engine packing had been allowed to deteriorate; some had been stored near heat and dried out—other had been left exposed to dirt and grit and could not be used. Wire inserted packing was found which had been folded and split.

Rubber mats had been folded and split by other weights being put on them.

Asbestos pipe covering had been stored horizontally, so the upper layers had crushed the lower.

Cement (in bags) had been stored under leaky roofs and in cellars, where it was ruined by water.

At one point the men from an adjoining pumping station took their noon-day smoke reclining on the bales of cotton waste.

At another point bales of cotton waste and barrels of kerosene were kept in the same room.

Much equipment was left in the open where it rapidly deteriorated.



PHOTO. 5.—OLD STOREHOUSE—24TH STREET YARD.



PHOTO. 6.—NEW STOREHOUSE—24TH STREET YARD.



PHOTO. 7.—INTERIOR VIEW—OLD STOREHOUSE—24TH STREET YARD.

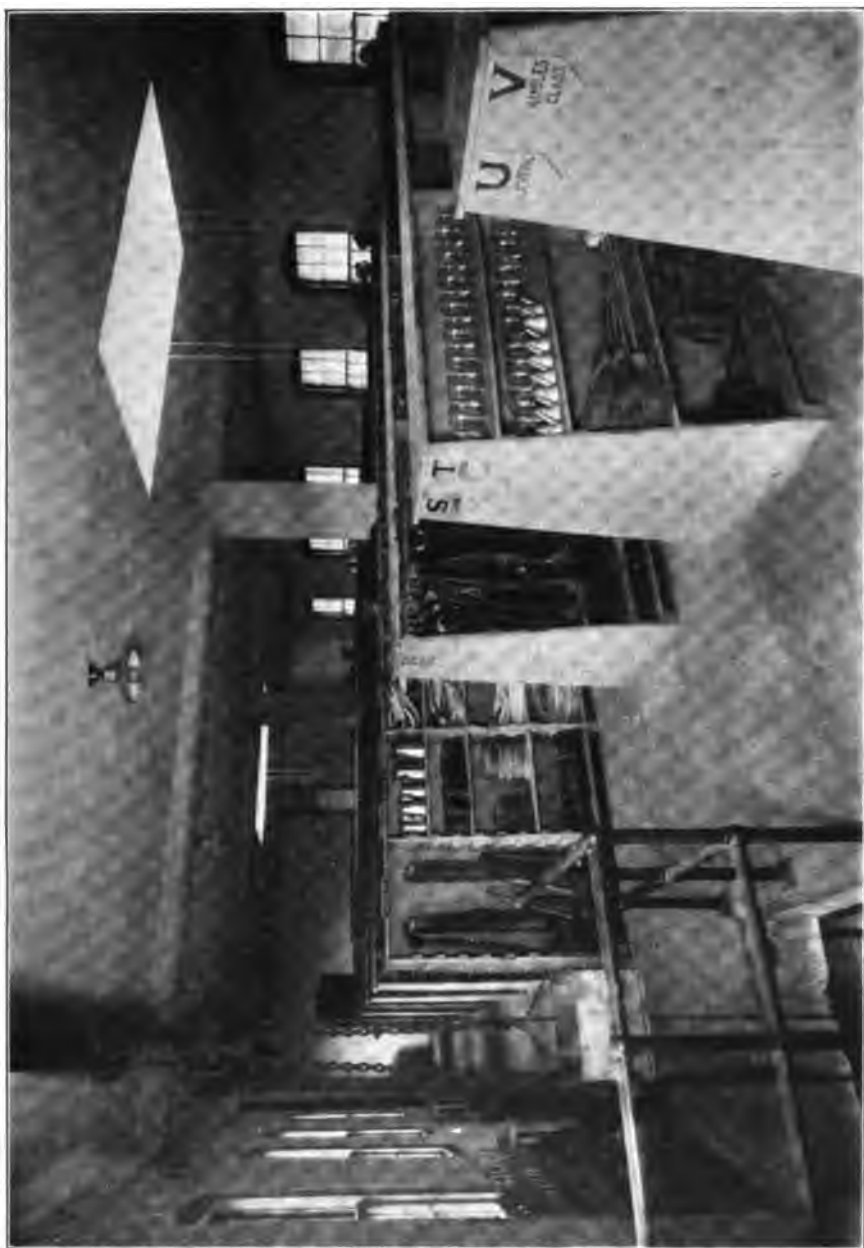


PHOTO. 8.—INTERIOR VIEW—NEW STOREHOUSE—24TH STREET YARD.



Photo. 9.—INTERIOR VIEW—OLD STOREHOUSE—24TH STREET YARD.

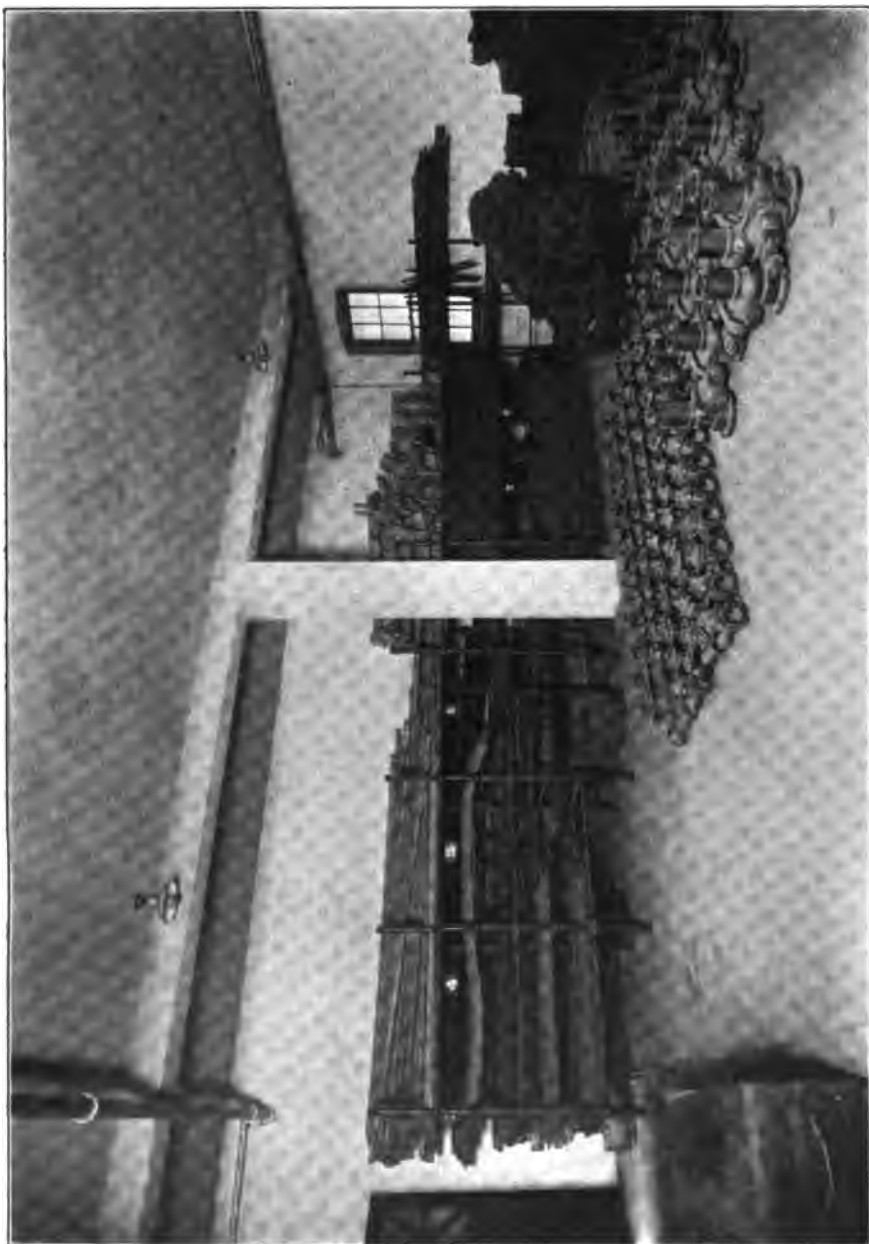


PHOTO. 10.—INTERIOR VIEW—NEW STOREHOUSE—24TH STREET YARD.
(Present method of storing pipe—iron—suction pumps—shown in photo. 9.)

had learned the details of the new system, and had become familiar with the stock, the methods of storing it and the preparation of the various reports, they were then detailed to some of the new storerooms which have since been put in operation. These men were next transferred from one storage point to another so that they became familiar with them all. Storekeepers thus can be assigned to any station to meet any emergency or press of extra work, and instead of being unacquainted with their surroundings, they are thoroughly familiar with the place, the stock and the work to be done.

Storerooms.

Many storekeeping systems require the location of the central storerooms close by the shops where the materials are to be used or repaired. As the water department does not use stock for manufacturing purposes, and as but little repair work is done, the conditions governing the locations of our storerooms were convenience for delivery and facilities for distribution to the pumping stations and repair companies to be served.

Having selected a location for a storeroom, it became necessary to fit it up for the work. Many of the old buildings previously used for supplies were so unsuited for the purpose that they have been replaced or abandoned and others taken in their stead. One of the essentials for proper care of materials is space. Cramped quarters are a very great handicap to efficiency, for there must be plenty of room for expansion of stock, for facility in handling it and also to permit of proper storage, such as the separation of materials on the basis of kind, size and frequency of demand.

The design of the old bins was poor.

1. The bins were too high.

Wall bins only should be built to a height requiring step ladders to reach the upper shelves. Where step ladders are used the running or "trolley" type is to be preferred.

Even where high wall bins might be used, it is generally preferable to use a low bin on the main floor and then put in a gallery to carry a second tier of bins.

2. The bins had vertical fronts which:

- (a) Narrows the aisle space.
- (b) Makes dark interiors.
- (c) Had upper shelves so deep that it was difficult to reach stock far back on such shelves.

3. The added depth of the shelves below the four-foot level was very inconvenient.

- (a) It holds a man away from the upper shelves.
- (b) It restricts the aisle space.
- (c) It makes the lower bins dark.



Рното. 11.—OLD STORAGE BINS AT RIDGEWOOD.

The bins were too high. The vertical fronts wasted space. The shelf at the four-foot level was inconvenient. The lower bins were so deep that it was impossible to reach stock at the back. The stereotyped design of shelving not suited to the stock. The use of front boards was objectionable, as it was impossible to keep the shelves clean.

4. The lower bins were so deep that it was impossible to reach small stock at the back.

5. Where all bins had the same stereotyped design of shelving they did not lend themselves to the various kinds of goods carried in stock.

6. The construction of the old bins was such that the height of shelves and the width between vertical partitions could not be readily changed to accommodate the different sizes of goods carried.

7. The universal use of front boards was objectionable.

(a) They made it practically impossible to keep the shelves clean.

(b) They were inconvenient and restricted storage space where the length of the article to be stored exceeded the depth of the shelf.

(c) They made it hard to get at the goods behind on the upper shelves.

(d) While sometimes permissible in lower bins where loose stuff (nuts, bolts, etc.) were kept, front boards were bad for "package" stores and tools.

The new bins have all been built with sloping fronts.

1. These bins are of such height that a man standing on the floor can easily handle stock placed on top.

2. The advantages of sloping bins are:

(a) They give better light to the interior of the bins.

(b) They are more accessible as they can be climbed like a ladder.

(c) They give more alley space.

(d) Upper shelves usually have small package goods kept on them. These goods have no great depth and do not require a deep shelf. With a sloping bin having shallow upper shelves, these goods are more easily inspected and are more accessible.

(e) Weights are often kept at the front edge of the shelf. With a vertical bin this tends to tip the bin forward. With a sloping bin, the weights are kept nearer the back of the bin, and gravity tends to hold the bin in place.

Stores Procedure—Inspections.

When goods are delivered by a manufacturer or dealer at a department storeroom, they are put in a separate room or cage and kept there till they are inspected. Except in rare instances of some special or unusual supply, the inspections are made by the storekeeper himself the day the goods are received. To enable him to do this work, he is furnished with a copy of the order on which the material was purchased and he is supplied with the latest specifications. If in doubt concerning the acceptance or rejection of any supplies he notifies the central office to send an inspector to pass on it. When goods require an analysis to determine their quality, the storekeeper immediately sends a sample to the laboratory for test.



Рното. 12.—NEW DISTRIBUTING STOREHOUSE—RIDGEWOOD.
(Just completed. Stock now being moved in.)

Low bins on main floor. Gallery carries second tier of bins. Bins have sloping front. Individual bins designed for the stock they will carry. No front boards used, insuring order and cleanliness. Adjustable partitions and shelves.

When materials are rejected, no distinguishing mark is put upon them to prevent their being mistaken and issued as good stock, for such mark might prevent the contractor who supplied the goods from selling them to someone else later. Instead, it is found to be best to take all rejected materials out of the inspection cage and place them in a room by themselves.

When goods are accepted, they should be marked with the name of the department (stencil or brand) and then duly entered into stock.

There is now much second-hand material returned to stock by the operating divisions. This material should be passed upon by a Board of Survey (page 13). Good material should be put into stock, damaged material worth repairing* should be repaired at once and then put into stock, worthless material should be scrapped and disposed of at the first opportunity.

Storage.

Printed instructions have been issued to storekeepers for the purpose of standardizing the best practice for the care of the stock and the transaction of business. The following are examples:

Rule 1. Storekeepers shall report for duty at their assigned stations at 8 A. M. and remain till 5 P. M. unless otherwise ordered. Saturday the closing hour will be 1 P. M. Storerooms will be closed on Sundays and legal holidays.

Rule 2. The first duty of every storekeeper shall be to properly care for the stock entrusted to him.

Rule 3. Storerooms must be kept locked, and no one admitted unless accompanied by storekeeper.

Rule 4. Every endeavor must be taken to protect stock from damage by improper storage, by weather or by fire.

Rubber goods must be kept away from heat.

Rubber boots and coats must be unpacked and hung up.

Packing must be kept from damage by heat, grit, dirt, etc.

Cement must be kept away from all moisture.

Lumber must be protected from the weather.

The exposed surfaces of valves, fittings, hydrants, etc., should be protected where they are kept in the open, and all bright or machine surfaces (threads, valves, etc.) should be adequately protected by coatings of oil, white lead or machinery slush.

Fire extinguishers must be kept filled and properly tagged.

Buckets of sand must be kept near the door in all rooms where oils, gasoline, etc., are stored.

* Standard practice instructions concerning the care and storage of second-hand fittings which it is proposed to use again state: "Fittings should be put in repair as soon as possible after they arrive at the yard and before they are returned to stock. They should be cleaned of scale and rust (possibly by sand blast or by the use of wire brushes); they should then be painted and all 'bright' or bearing surfaces protected by oil or white lead."

No accumulations of rubbish, excelsior or wrapping paper shall be allowed in any storeroom.

All oil rags or waste must be kept in a covered metal container when not in use.

No smoking shall be allowed in storerooms.

Rule 5. Storerooms must be kept clean and in perfect order at all times.

No stock or materials shall be left lying around.

No goods shall be allowed to block the aisles.

Rule 6. All stock delivered to stores must be unpacked and inspected at once. If the nature of the material requires an analysis, a sample must be sent to the laboratory. If the storekeeper is not familiar with any such stock he must notify the Chief of the Bureau and an inspector will be sent to pass upon it.

Rule 7. As soon as goods are inspected the result must be reported to the Chief of the Bureau.

(a) If the goods are accepted they will be marked with the name of the department and at once entered into stock. The stock cards will be altered and the quantity entered upon the "Stores Received" Sheet. The bills will be marked O.K. and forwarded to the central office.

(b) If goods are rejected they will be removed to the "rejected material" room and the fact reported to the Chief of the Bureau of Supplies on the regular form.

Rule 8. All goods of like character shall be stored together.

In the pipe yards where supplies and spare parts are carried boards will be constructed for each type of hydrant and valve. On each board will be tacked the various parts constituting the mechanism of said hydrant or valve. Over each part will be stencilled a number, which will correspond to the number of the bin containing the stock of the parts in question.

This will do away with the necessity for a man looking through a large number of cubby-holes for the piece he wants, "pawing" over a quantity of stock in the process. Instead, before he goes to the bin he will identify the piece he requires by looking on the stock board.

Store Cards—Perpetual Inventories.

A card is made out for every class and size of stock. These store cards, besides describing the articles, give their location in the storeroom, their unit price, and the dates and amounts of all receipts and issues. They thus constitute a "perpetual inventory" and show at all times the quantity and value of the stock.

Inventory.

The Bureau of Supplies started the first inventory ever taken of the supplies of the Department. The count of the stock in the main storerooms was the first authoritative list giving the nature, amount and location of the stock owned. The card index above referred to acts as a perpetual inventory. It is planned, however, regularly to count all stock in storerooms at least twice a year. This will be a check and will show all the small mistakes which have crept into the card record. But few discrepancies are an indication of the efficiency of the storekeepers, although they do occur even with the greatest care; the "shorts and overs" so found are taken care of on adjustment blanks.

Consumable and Non-consumable Supplies Compared.

Supplies should be divided into two classes; consumable and non-consumable. Fuel, oils, waste, packing, paint, and lumber are examples of the first class; whereas tools, implements, harness, rubber boots, belong to the second group. It should be arranged as soon as possible that none of the "non-consumable" supplies be issued till those they are to replace have been turned in. Thus a man does not get a new saw until he returns the old one and shows that it has been worn out. He does not get a new pair of rubber boots until he returns the old ones and is able to demonstrate that they have rendered the most service that was in them. This not only gives the purchasing division an opportunity to inspect the goods after use and ascertain what service they gave, but it prevents departmental property being used for personal purposes or sold for profit, or so carelessly guarded and protected after issue that it is either lost or stolen.

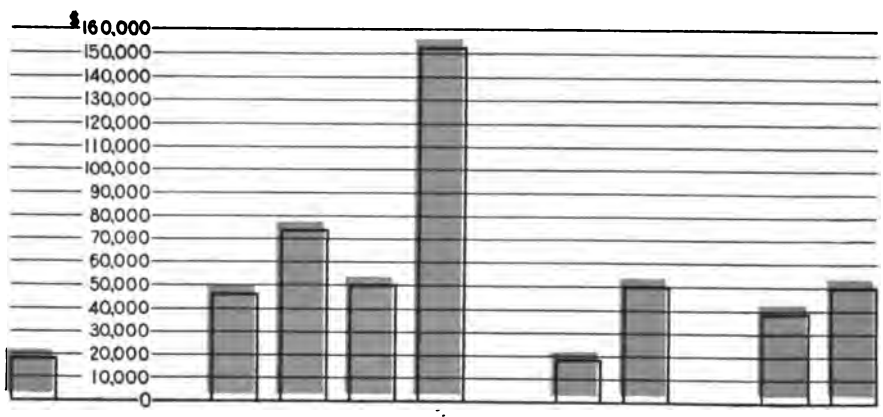
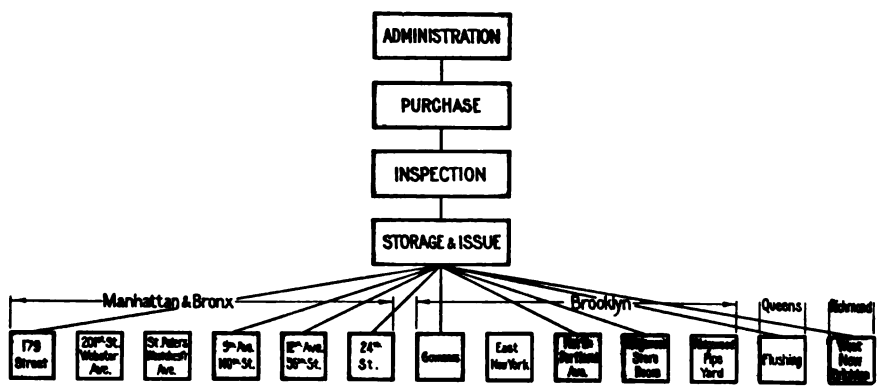
Issues.

When material has been returned to stock it is to be re-issued before regular stock. To prevent loss from depreciation, all other supplies should be issued in rotation, for when stores are given out in the order in which they are received, no old material is left on the back of the shelf to deteriorate and subsequently be thrown out.

The difference between a central storeroom, which is part of a general stores system, and a local stock room, should be clearly understood. To be effective the stores system should be a wholesale proposition. Continual application to storekeepers for a bit of this or that is bad business for many reasons.

- 1st. Every time a man goes to stores for stock it takes his time going and returning. A continual running back and forth is not only wasteful of time, but indicates that the employee is so poorly versed in the work he has to do or is so careless, that he does not keep sufficient stock close at hand.

MONEY VALUE OF STOCK AT STORAGE POINTS UNDER THE BUREAU OF SUPPLIES.



2d. Every time a storekeeper is called on to fill a requisition a certain amount of his time is consumed, not only in getting the goods off the shelf, but in altering his stock card and making out the "stores issued" report for the Central Office. Time thus taken would otherwise have been spent in caring for the stock on hand.

3d. Every time an article is issued from a storeroom a corresponding change has to be made in the ledgers in the stores control office. The fact must also appear on all records affecting materials issued from stores and received by employees. Annual and quarterly reports of stock issued are now largely composed of a multitude of small items of this sort. The extra amount of bookkeeping which this entails is beyond measure and entirely unnecessary.

Local Stock Rooms.

Local stock rooms should contain such supplies and materials as are in current demand and there should be sufficient quantities to last a month. The man having the key to this room is generally the man using the goods. He gets a quantity of goods at the first of the month, which is supposed to suffice till the next supply arrives. As he needs a bit of waste, a piece of packing, a plank or a handful of nails he takes them. All that is necessary to account for small local stock issues is to subtract what is left at the end of the month from what was on hand at the beginning. To this should be added any emergency supplies or other "direct deliveries." On the other hand, to figure local consumption day by day is often a waste of time. It bothers the poor man who uses the material. It makes work for a lot of clerks at the central office which costs in salaries, and it is of little use in promoting economy or efficiency.

Storekeepers are furnished with the names of those authorized to draw supplies, also the locations of all subsidiary stock rooms to be supplied. No storekeeper can draw a requisition on himself for supplies. All stock in storerooms is held in trust for the division out of whose funds it was purchased. If a storekeeper wants mops, brooms or other implements for carrying on his work they must be purchased for him and charged up to appropriations especially allowed for that purpose.

All material going out of storerooms is not issued for consumption. Some is loaned and some is transferred to other storerooms to be issued by them.

Loans.

It frequently happens that the work of the city can be expedited by loaning a few lengths of pipe, a valve or some other equipment to a contractor who has a city contract but whose work is held up because he is unable to get supplies from his foundry. The material thus loaned is replaced by the contractor with similar stock at the earliest moment.



PHOTO. 13.—INTERIOR VIEW OF A LOCAL STOREROOM AT A PUMPING STATION AS IT WAS FOUND BY THE BUREAU OF SUPPLIES WHEN THEY ASSUMED CONTROL.

Transfers.

Transfers are something to be reduced to a minimum. They are costly and indicate an incorrect distribution of supplies in the first instance. Maximum and minimum stock limits will do away with this. They are necessary, however, to meet emergencies.

Regarding transfer of supplies from one borough to another: At the beginning of the present administration there was no record at any central point of the supplies to be found in any one of the five boroughs; consequently transfers from one point to another could not be made except by communicating with the different yards to see from which one the desired material could be obtained. Under the new system there is a record in the stores control office giving the supplies in all the central storerooms, and by consulting such record the transfers can easily be made.

Distribution.

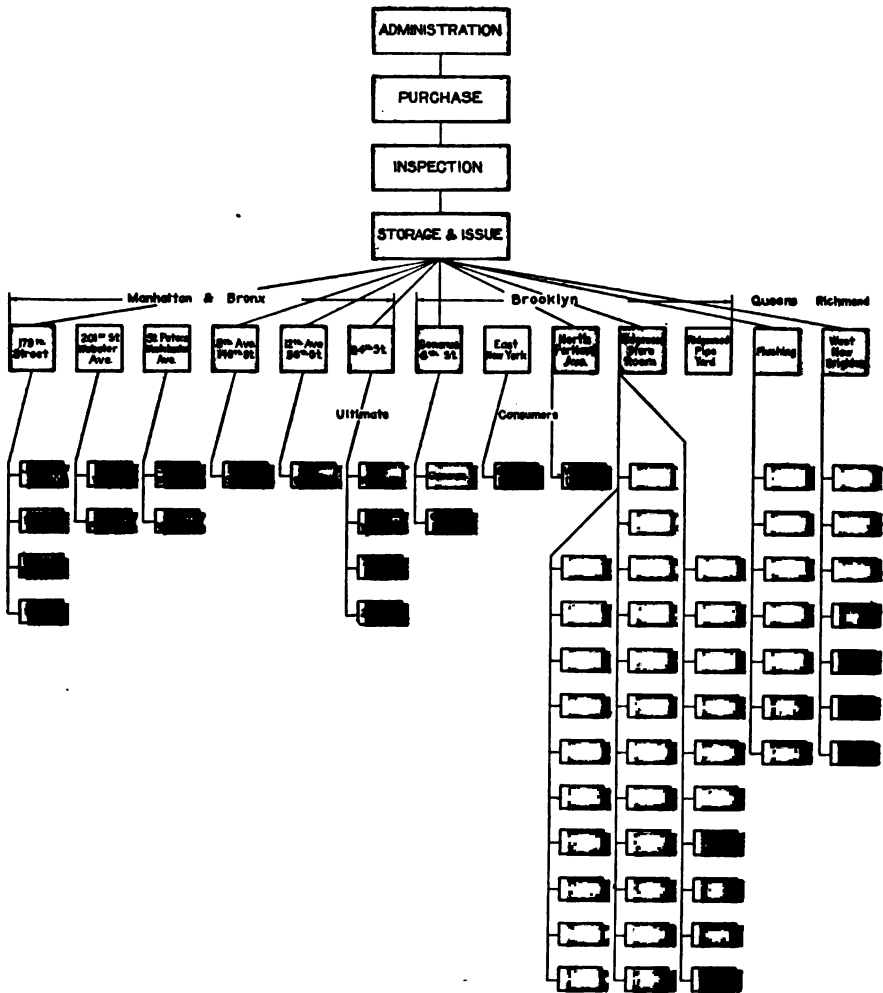
The practice of having manufacturers and dealers make direct deliveries to local consumers should be stopped except in cases of emergency. All material* purchased on Open Order or Contract should be delivered at the central storeroom supplying the point to which the supplies are ultimately going. The supplies should be unpacked and inspected by the storekeeper, and then recreated by him and forwarded to their destination by departmental auto truck.

Definite steps should be taken to provide adequate facilities for making deliveries of supplies from storerooms to points of consumption. A truck should be assigned to the different storerooms on certain days each week to make these local deliveries. The trucks used for this purpose would also serve to get men and supplies to any place where they might be needed to meet an emergency. Considering the long distances to be covered in this service, the auto truck is ideal. Among its advantages as contrasted with horse-drawn vehicles are:

1. Better speed in reaching emergency points.
2. Greater carrying capacity for both men and material.
3. Less space for storage both of vehicle and motor at the yards.
4. The convenience of having power-driven windlasses on the track, particularly for unloading and lowering into trenches.
5. Superior economy, because no expense is incurred when the truck is not in use.
6. Diminished number of men needed as hostlers, for equal or greater capacity as compared with horses.
7. No delay from prostration of horses in summer heat.
8. Less interference in winter from snow in streets.

* Except coal, lumber, heavy castings large shipments of cement and material of like nature which is bulky and expensive to load and unload.

CHART SHOWING DISTRIBUTION SYSTEM OF SUPPLIES
FROM GENERAL STORES TO ULTIMATE CONSUMERS.



9. The service zone of the truck is very much greater, therefore fewer trucks are needed.

10. A superior sanitary cleanliness at the yards.

Stock Limits.

It has been pointed out that, whereas an oversupply of stock in storehouse is a needless expense, an inadequate one is fatal to the efficient carrying on of the work of the department, and it becomes an absolute menace when the reserves get so low that there is not sufficient material on hand to meet the demands of any emergency.

The problem of fixing stock limits should begin with the consumers. To do away with unnecessary or excessive local reserves, the following lists should be made for each point (repair company, pumping stations, etc.) where supplies are *used*:

- (a) Emergency equipment.
- (b) Engine spare parts.
- (c) Tools and implements.
- (d) Current supplies and equipment required per month for operation and maintenance.

An inspection of each point should be made and it should be seen to that *all* the above articles are on hand.

All surplus tools, all over-equipment and all equipment not available for the engines in use at the stations where it is stored, should be immediately returned to the central stores.

Some stations were carrying supplies and equipment (gaskets, packing, spare parts, etc.), for apparatus and pumps no longer in use, and in other cases, supplies were carried for machines which had long since been removed to some other station or sold for junk.*

All supplies left for use must be in good condition and available for immediate service.

All supplies and equipment left at local points should be branded or otherwise suitably marked to indicate that it is departmental property.

A classified inventory of all such supplies should be prepared and furnished to the man in charge of the station. Thereafter he should be held responsible for their safekeeping. At the end of each month he should submit a list of stores used which should be checked against the inventory and the deliveries and will be used in computing operating costs.

Supplies constituting emergency equipment should be gathered together in one room. They should be sorted, classified, and so arranged that they can be obtained *instantly* when needed.

* One storekeeper reported that surplus stock sent to his storeroom from local pumping stations contained 566¼ pounds of packing (worth about \$500) which did not fit any equipment in the Borough where it was found.



PHOTO. 14.—OLD STOREROOM AT RIDGEWOOD.

(Poorly designed bins. Restricted aisle space. Floor cluttered with stock. Goods piled in front of bins prevent access to goods on shelves.)



PHOTO. 15.—OLD STOREROOM AT FLUSHING PUMPING STATION.

(Note: Rubber mats folded and split by other goods piled on them. Packing ruined by improper storage.)



PHOTO. 16.—AN INVESTIGATION BY THE BUREAU OF SUPPLIES DISCLOSED THIS CONDITION.
(Valuable stock stored with junk in the cellar of a pumping station.)

All engine spare parts should be gone over to see that they are in proper condition and steps should be taken to keep them so. (Bright surfaces should be coated with "machinery slush," bearing surfaces protected, etc.)

All tools needed at the stations should be arranged on boards conveniently located about the plant. Under the hooks on which the various tools are hung when not in use, should be painted in red the outline of the tool. Thus a glance at any tool-board would suffice to show what tools are in use or missing.

Implements should have stenciled on them the place where they belong. Thus wheelbarrows may be marked "boiler-room," ladders marked "paint-shop," tools marked "Wagon No. 1." This prevents misplacement and puts a check on indiscriminate borrowing.

Current equipment should be kept by itself. Its storage, arrangement, inspection and issue should be governed by special rules.

Stock Limits in Central Stores.

Next, having decided what consumers should be supplied from any given central storeroom, the sum total of their monthly requirements should give the average monthly business of that storeroom. Using this as a basis it will be a comparatively simple matter to determine the proper amounts of each of the various items to keep on hand. To this must be added such accumulations of stock as are made from time for new work, alterations or other improvements.

Combining the annual requirements of the central or distributing store-rooms will give the needs of the department for standard supplies for a year. This total is the basis for a Supply Budget on which the yearly request for funds can be estimated and defended. The fluctuations in the demand for supplies will indicate the proper purchasing policy to be put in force.

A constant endeavor is being made to substitute a proper routine for the present haphazard way of drawing stock from storerooms. Requisitions are continually coming in for waste, packing or pig lead, generally accompanied by a note to the effect that the sender is all out of that particular article and must have some at once. The Bureau of Supplies does not have the ordering of material in the first instance; it often happens therefore that the central storeroom itself is all out of the material so urgently needed.*

It is this condition of affairs that leads to so much material being purchased direct by the various Bureaus marked "Confirming Verbal Order"—"For Emergency."

The proper solution of the difficulty would be to have all men who use supplies take count of their local stock at the first of each month, and make

* To prevent this a letter is sent every week to the different Borough Engineers, giving a list of articles which have been called for at storerooms and which are completely out of stock. An asterisk indicates items previously reported as being out. To this list is added another of items, the stock of which appears to be far too low.

out a requisition on stores for such articles as will be required to carry them through the month. This would develop forehandedness and would result in orders for additional stock being sent to storerooms in advance of the time when it is urgently needed.

Conclusions.

The method of permitting the Supply Bureau only to purchase supplies when and in quantities specified by other bureaus has been tried and found wanting. It is a question which has been the greater—the foolish ordering and purchasing of material not needed, or the urgent demands on the storehouses for materials which certain officials have failed to provide.

The probable requirements of all consumers for current supplies having been determined, the Bureau of Supplies should be directed to purchase the same, and to keep the central storerooms at all times so stocked with standard supplies that current requisitions can be filled on sight.

Naturally, materials for special purposes must be ordered in advance by the parties requiring them.

Much of the foregoing cannot now be carried out because the true function of a Bureau of Supplies has not yet been fully realized and the Bureau's authority extended to include this service.

To obtain the best advantage of a proper storekeeping system, the Chief of the Bureau should be in close touch with all the activities and aims of the Department, and his Bureau should not merely purchase, inspect, store and issue supplies, properly and economically, but it should see that a proper stock of current requisites and of emergency supplies are always on hand and that articles purchased are necessary and are those best suited for the purpose to which they are to be put. It should further ascertain that the supplies are actually used as intended, and finally when they have ceased to be of service should see that they are surrendered to it for salvage or sale as scrap.

CHAPTER VI.

RECORDS AND STATISTICS

Information required for proper accounting control—The collection of data and the preparation of charts and diagrams.*

In the Bureau of Supplies, as in all business, it is necessary to keep records and prepare statistics—the nature and extent of these records and the character and use to be made of these statistics vary, however, with every undertaking. For that reason it is impracticable to impose the records of one business upon another unless both are identical in all respects.

The various functional activities of the Bureau—purchasing, inspecting, storage and issue—were carefully considered in order to ascertain what information was necessary for honest and efficient administration. It was next determined how this information was to be obtained, and the use to be made of it.

Purchasing Records.

Requisitions for the purchase of goods used to be made on a variety of blanks, on odd pieces of paper and even by word of mouth. In place of all this, two regular forms were substituted, one for open orders and one for contracts. When filled out they show what is wanted and the estimated cost, where it is to be delivered, the use to which it is to be put, the date it will be needed, and a statement signed by the man ordering the goods and certified to by his bureau superiors that the materials so ordered are for the use of the City and are necessary. These requisitions are then investigated to see

First—If the goods can be supplied from stock on hand in storerooms.

Second—If there is any already ordered.

Third—If the quantity appears to be correct.

Fourth—If the quality appears to be right for the use intended.

Fifth—If there is a department specification for the goods, and if not, whether the requisition clearly describes what is wanted.

* Many of the new forms were designed with the aid and assistance of the Bureau of Municipal Research, New York City.

The determination of these matters called for a perpetual inventory of goods on hand, so that was arranged for under the storage records.

Forms were then prepared which greatly facilitated the work of making the purchases; and a ledger was started to show the state of forwardness of any contract, whether with the Corporation Counsel or with the Comptroller, or with the "City Record" for printing. Its records of the dates when papers were sent and when returned furnished the data for that most interesting and instructive diagram (page 30), which accounts for the time taken in letting a contract.

The purchasing records also show

What has been bought.

For whom it was bought, and

The cost.

Inspection Records.

A ledger was recently begun to show whether goods ordered have been delivered, if so, whether they have been inspected, and if inspected, the result. If goods are rejected, the contractor is notified, the date of replacement noted, the time required to reinspect recorded, and whether the goods passed or failed to pass. All these facts are put down and used as required, to follow up orders and receive prompt deliveries, to expedite inspections and check up the work.

Storage and Issue Records.

The establishment of a proper stores control is to be reckoned among the most important achievements of the past two years and a half.

The storerooms have records showing

What goods were received, and

From whom received.

What goods were issued and

To whom issued; also

The amount of stock on hand.

The reports of goods received and issued from storehouses sent daily to the central office, together with duplicates of all invoices, requisitions on stores, transfers, loans, and so forth, make possible a system of accounting where the control ledgers at headquarters can exercise the most perfect check on the accounts kept at the storehouses.

The present system insures the Auditor of the fact that all bills presented to him for payment are only for goods actually delivered, inspected and passed.

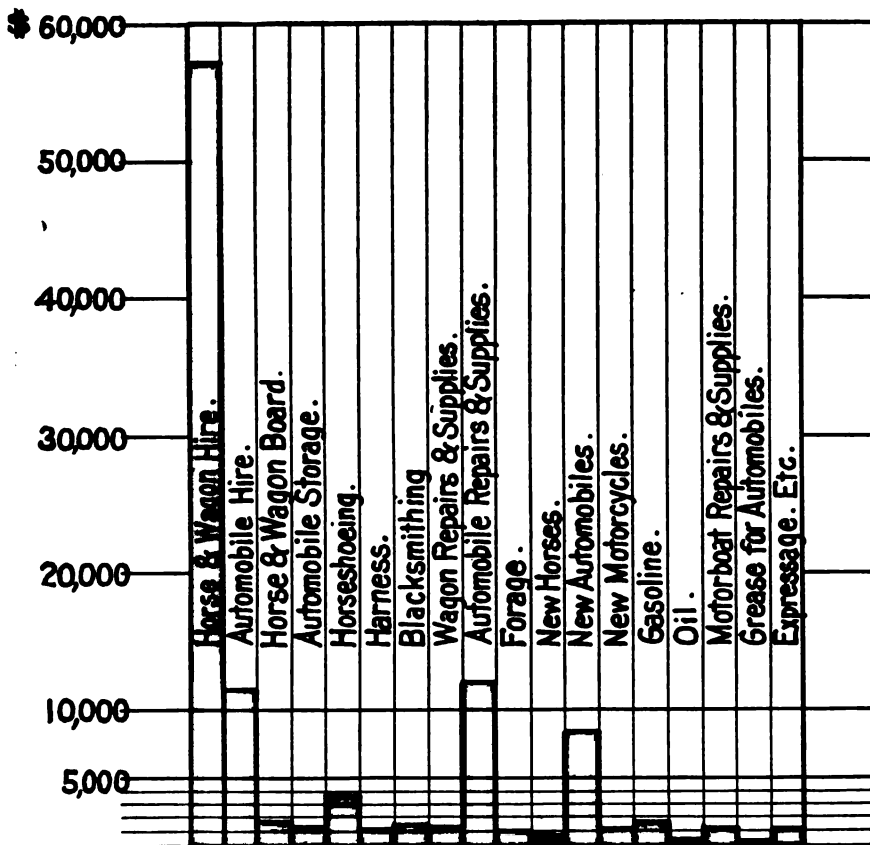
Finally, the present records show, day by day, the quantity and value of all stores under the charge of the Bureau of Supplies.

Statistics.

The activities of the Bureau have been chartered and are being investigated by the aid of diagrams. Matters of organization, lines of responsibility and the various steps necessary to transact the business of the Bureau are made clear and easily understandable by means of drawings. It is truly remarkable the way complicated masses of figures take shape and assume their true significance when plotted to scale. Examples of this work are to be found in the many plates illustrating the text of the previous chapters.

ANALYSIS OF ANNUAL TRANSPORTATION EXPENSES.

1912 Total, \$107,495.68.



TO THE
LIBRARY

Elihu Cunyngham Church was born in New York City on 19th August, 1881. He successfully completed the four-year course at the Horace Mann High School, entering Columbia University the following year, where he was graduated with the degree of Civil Engineer (C. E.) in 1904. The next three years were spent in engineering work. In the Fall of 1907 he returned to the University as "Assistant" in Civil Engineering. The following Spring he was appointed "Lecturer" in Civil Engineering—a position which he held for two years. Since then he has been Secretary of the Department of Water Supply, Gas and Electricity, New York City.

He has been in complete charge of the installation and administration of a Central Bureau of Supplies, and has directed and had personal charge of the letting of all contracts, and the purchasing, storing and issuing of all material used by the Department (approximate annual expenditure supervised is fifteen million dollars). He has standardized specifications, introduced new methods of accounting and stores control, built, equipped and operated large central distributing storerooms, and has developed and systematized a branch of work previously done in a haphazard manner or left to chance.

He has lectured on the subject before many technical societies, including The Efficiency Society, The American Water Works Association, The New England Water Works Association, and the students in Engineering at Columbia University. Articles concerning his work have been published in all the leading engineering papers in the country.

Mr. Church received the degree of Master of Arts (A. M.) from Columbia University in 1909.

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